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International Atomic Energy Safeguards

prepared for The Arms Control and Disarmament Division, Department of External Affairs, Ottawa, Ontario, Canada

89-01797/

The cover graphic is based on an ancient Egyptian hieroglyph representing the all-seeing eye of the powerful sky god, Horus. Segments of this "eye in the sky" became hieroglyphic signs for measuring fractions in ancient Egypt. Intriguingly, however, the sum of the physical segments adds up to only 63/64 and, thus, never reaches the equivalent of the whole, or perfection. Similarly, verification is unlikely to be perfect.

Today, a core element in the multilateral arms control verification process is likely to be the unintrusive "eye in the sky," or space-based remote sensing system. These space-based techniques will have to be supplemented by a package of other methods of verification such as airborne and ground-based sensors as well as some form of on-site inspection and observations. All these physical techniques add together, just as the fractions of the eye of Horus do, to form the "eye" of verification. Physical verification, however, will not necessarily be conclusive and there is likely to remain a degree of uncertainty in the process. Adequate and effective verification, therefore, will still require the additional, non-physical, element of judgement, represented by the unseen fraction of the eye of Horus.

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Ottawa (Ontario)
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Department of External Affairs
Cat. No. E54-8/1-1988E
ISBN 0-662-16526-8
ISSN 0840-772X

International Atomic Energy Agency Safeguards

Observations on Lessons for Verifying a Chemical Weapons Convention

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September 1988

prepared for

The Arms Control and Disarmament Division, Department of External Affairs

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Table of Contents

	Page
List of Tables and Figures	v
Abstract	vii
Résumé	viii
Preface	ix
Acknowledgements	x
List of Abbreviations	xi
INTRODUCTION	1
PART 1. Some General Considerations	4
What Does the Agency Do?	4
Objectives and Problem Definition	4
"Threat" Coverage	10
Agency Effectiveness	12
The Political Base	17
Supplier Power	18
A Non-Proliferation Norm	20
The Use of an International Organization	21
Standardization and Legitimization	21
Relations With Other International Organizations	22
Some Side Benefits and Costs	23
PART 2. Some Specific Considerations	28
IAEA Relations with States	28
Safeguards, Membership, Functions and Financing	28
Personnel Policies	29
Confidentiality and Transparency	31
Privileges and Immunities of Inspectors	32
Field Offices	33
The Designation of Inspectors	33
Constraints on Agency Safeguards Rights	34
Sanctions	34

Dispute Settlement 35
Internal Functioning 35
Political Structures 35
The Director General 37
Staffing Policies 38
The Inspectorate 39
Support Services 41
The Safeguards Systems 42
Detailed Verification Objectives 42
Inspections 44
Anomalies 46
Safeguards Evaluation and Improvement 47

PART 3. Summary and Conclusions 48
Some Lessons from The IAEA's Experience 48
Broad Objectives, Tasks and Threat Coverage 48
Safeguards Character and Effectiveness 49
Safeguards-Supply Linkages 52
The Political Support Base 52
Relations with Other Monitoring Organizations 53
Organization and Functioning 53
Miscellaneous 54
Areas for Further Study 55

BIBLIOGRAPHY 58

List of Tables and Figures

Table 1:	Similarity between the Requirements of IAEA Safeguards and Those of Verifying a Chemical Weapons Convention	3
Table 2:	Some Key Definitions	7
Table 3:	Growth of the IAEA	14
Table 4:	IAEA Departmental Budgets and Personnel Levels, 1987	40
Table 5:	Divisional Budgets and Personnel Levels, IAEA Department of Safeguards, 1987	40
Figure 1:	The Safeguards Approach	5
Figure 2:	Amounts of Nuclear Material under IAEA Safeguards	12
Figure 3:	Nuclear Power in Canada	26
Figure 4:	Canada's Chalk River Nuclear Laboratories	27
Figure 5:	Organization Chart of the IAEA	36
Figure 6:	IAEA Inspections: Installing and Checking Containment Seals	43
Figure 7:	IAEA Inspections: Surveillance Equipment	45

Abstract

As an international agency that has been engaged in the verification of compliance with obligations respecting nuclear facilities and materials for more than 20 years, it is natural that the International Atomic Energy Agency (IAEA) should be considered as a possible model for verification organizations in other arms control and disarmament areas. This study was initiated to examine the lessons that might be learned from the IAEA's experience and that might be applied to another arms control area - that of a comprehensive chemical weapons convention.

The study examines the political, organizational, legal, financial and technical aspects of the Agency's experience. The non-technical aspects focus on the significant features of both the Agency's internal structure and operations and the broader environment in which it must function. The study looks at the approach to the control problem taken by the Agency – its definition of the problem and of its own objectives – and the coverage it provides with respect to possible routes for acquisition of nuclear weapons. It considers the factors affecting the Agency's political and technical effectiveness. Recognizing that the Agency's roots lie in the promotion of the benefits of peaceful uses of atomic energy, the study examines the political base of the Agency's activities, in the power of suppliers of nuclear goods and services and in the existence of a broad norm or presumption against the spread of nuclear weapons. It also examines some issues arising from the use of an international organization for the performance of verification tasks.

The specific features of the Agency's structure and operations considered by the study include its relations with states (including aspects of its personnel policies, the designation of inspectors, and information management). They also include a brief examination of the political structures of the Agency and of the safeguards system.

The study concludes with a tentative set of lessons that could be derived from the Agency's experience and suggestions for areas of further study.

Résumé

L'Agence internationale de l'énergie atomique étant un organisme international qui, depuis plus de vingt ans, s'occupe de vérifier si les obligations relatives aux installations et aux matières nucléaires sont respectées, il était tout naturel de l'envisager comme modèle possible pour des organismes de vérification oeuvrant dans d'autres domaines du désarmement et du contrôle des armements. La présente étude a été entreprise afin d'examiner les leçons que l'on pourrait tirer de l'expérience de l'AIEA, lesquelles pourraient s'appliquer à un autre domaine du contrôle des armements, soit une convention d'ensemble sur les armes chimiques.

L'étude analyse les aspects politiques, organisationnels, juridiques, financiers et techniques de l'expérience de l'Agence. Les aspects non techniques qui y sont abordés portent sur les caractéristiques importantes de la structure et des opérations internes de l'Agence, et sur celles de l'environnement plus large dans lequel celle-ci est appelée à évoluer. L'étude traite de la manière dont l'Agence a abordé le problème de contrôle – sa définition du problème et de ses objectifs – ainsi que de la couverture qu'elle offre sur les voies possibles d'acquisition d'armes nucléaires. Elle examine également les facteurs qui influencent l'efficacité politique et technique de l'Agence. En reconnaissant que la raison d'être de l'Agence est de promouvoir les avantages des utilisations pacifiques de l'énergie atomique, l'étude analyse le fondement politique des activités de l'Agence en ce qui concerne le pouvoir des fournisseurs de produits et services nucléaires et l'existence d'une norme ou d'une présomption générale contre la prolifération des armes nucléaires. L'étude aborde également certaines questions qu'amène le recours à un organisme international pour l'exécution de tâches de vérification.

Parmi les caractéristiques propres à la structure et au fonctionnement de l'Agence, l'étude traite des relations que l'Agence entretient avec les États «y compris les aspects de sa politique sur le personnel, la nomination des inspecteurs, et la gestion de l'information». Elle donne aussi un bref aperçu des structures politiques de l'Agence ainsi que du système de garanties.

En conclusion, l'étude propose une série de leçons que l'on pourrait tirer de l'expérience de l'Agence et suggère certains sujets d'étude qu'il serait bon d'approfondir.

Preface

Dr. James F. Keeley is an Associate Professor with the Department of Political Science at the University of Calgary and is associated with that University's Strategic Studies Programme. He has studied the IAEA for a number of years and agreed to undertake this study at the initiative of the Department of External Affairs. The research for this study was conducted during the period 1985 through 1987. It included several weeks of interviews and research in Ottawa and Vienna.

The IAEA has often been cited generally as an example of a functioning verification system that could be emulated in other areas of arms control. The specific task undertaken by Dr. Keeley was to examine in detail in what ways the IAEA's experience could serve as a model in other arms control contexts. Dr. Keeley's report provides general observations on the lessons that the IAEA can teach respecting arms control verification. It concentrates, in particular, on the relevance of these lessons for verifying a comprehensive chemical weapons convention. Dr. Keeley concludes his paper with a number of suggestions for further research in this area. However, this paper does not contend that all these suggestions need be undertaken before concluding a convention on chemical weapons.

Acknowledgements

The author is grateful to the officials of the International Atomic Energy Agency, the Department of External Affairs and the Atomic Energy Control Board of Canada for their co-operation in the research for and preparation of this study.

List of Abbreviations

AECB	Atomic Energy Control Board
AECL	Atomic Energy of Canada Limited
ARIE	Actual Routine Inspection Effort
CW	Chemical Weapons
EURATOM	European Atomic Energy Community
IAEA	International Atomic Energy Agency
INFCIRC	Information Circular (IAEA document designation)
MBA	Material Balance Area
MRIE	Maximum Routine Inspection Effort
MUF	Material Unaccounted For
NPT	Non-Proliferation Treaty
NSG	Nuclear Suppliers Group
RECOVER	Remote Continuous Verification (system)
UN	United Nations

Introduction

The International Atomic Energy Agency came into existence in 1957. Its dual objectives, as expressed in Article II of its Statute are to

> *seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose.*

From its beginning, therefore, the question of safeguarding nuclear goods and services to prevent their use for certain purposes was a central issue in the Agency's existence.

Its first safeguards system was devised in 1961 (INFCIRC/26) and subsequently revised to form the major safeguards system outside the Non-Proliferation Treaty, the INFCIRC/66 system (as of 1968, INFCIRC/66 Rev. 2). A second system, elaborated in INFCIRC/153, was devised following the coming into force of the Non-Proliferation Treaty. A revised version of this second system is applied to nuclear weapons states that are party to the NPT.

The Agency has now been engaged in safeguarding nuclear materials and facilities for over two decades. The once-novel principle of verifying national activities through an international organization has become widely accepted within the realm of peaceful nuclear technology. Although there are other examples of verification by international organizations, such as the activities of the European Atomic Energy Community (EURATOM) and of the Armaments Control Agency of the Western European Union, the IAEA is the premier example of such activity. As such, it stands in substantial contrast to the reliance on unilateral, essentially adversarial, verification systems in other arms control realms. It is true that there are co-operative aspects even in verification agreements between adversaries: it may be in the interest of one party to make certain information known to the other. However, such arrangements characteristically depend directly on national monitoring systems and evaluations of information. The IAEA verification systems are developed and applied by an international entity, and their findings are, at least initially, evaluated by that international entity.

The Agency's verification systems present a number of interesting features:

1. They are operated, as already mentioned, by an international organization rather than being a purely national system.

2. They employ technical means of verification which go beyond remote sensing to involve in-facility equipment and accounting methods, and include on-site inspection.

3. They have been applied in an area of substantial political, industrial and economic sensitivity, as well as of some technical intricacy.

4. They attempt to verify the use of facilities and materials while not infringing unacceptably on national sovereignty and on the permitted uses of those facilities and materials.

These features suggest that the Agency's methods and experience might be worth an extended examination. The second, third and fourth characteristics noted above suggest that the Agency's experience could be of special relevance to verifying arms control agreements that relate to other industrial production facilities and processes. It is not surprising, then, that this experience should be suggested as a possible source of guidance for the verification aspects of a treaty banning the development, production, stockpiling, transfer and use of chemical weapons and providing for the destruction of existing stocks of chemical weapons and their dedicated production facilities. The purpose of this study is to note some lessons from the Agency's experience for such an application and to suggest some areas for further research in this context.

A comprehensive ban on chemical weapons could present all or some combination of the verification requirements listed in Table 1. There are parallels between these requirements and the verification activities of the IAEA, which are clearest for the third, fourth and seventh requirements listed in Table 1, which involve the monitoring of production or transfers. There are also similarities for the first and second requirements, which involve the monitoring of facilities to verify the volume and character of material being disposed or to ensure that a facility supposed to be dismantled, shut down, or converted for other uses was not being operated illegally. Some form of inspection would be needed for requirements (5) and (6). While this could be in the nature of challenge inspections, in which the Agency has no experience, some aspects of its inspection experience could be of interest. Finally, the eighth requirement, to monitor scientific and technical advances, is an area in which the Agency does have some experience, through its efforts to modernize, upgrade and extend its safeguards activities.

While the Agency can be a valuable source of lessons for verification in other arms control areas, these lessons should be approached carefully. The use of the Agency as a "model" must be tempered by the recognition that its characteristics and performance must be studied and adapted, not simply mechanically transferred to other areas in which verification involving inspection may be desirable.

Verification Requirements of a Chemical Weapons Convention	Similarity between CW Verification and IAEA Safeguards
1. Destruction or disposal of declared stockpiles	Medium
2. Destruction, dismantling, conversion or mothballing of declared production facilities	Medium
3. Production and use of permitted amounts for permitted purposes	High
4. Non-production at declared facilities	High
5. Investigating allegations of use	Low
6. Investigating allegations of clandestine production	Low
7. Monitoring transfer of relevant materials, equipment, etc.	High
8. Monitoring technical and scientific advances	Medium

Table 1

Similarity between the Requirements of IAEA Safeguards and Those of Verifying a Chemical Weapons Convention

This study is organized into three parts: first, a general overview of some fundamental characteristics of the Agency's safeguards activities, and, second, an examination of some more specific and detailed issues. In both parts, political, legal, organizational and financial issues, as well as some more "technical" issues, will often overlap. Third, a summary of the lessons suggested in the study, and a list of some areas in which there should be further study, will conclude the paper.

Before going on, it is important to note that the issues dealt with in the paper are approached from a point of view which is not that of a state affected by the Agency's systems, and which may also not coincide with the IAEA's view of itself. The study does not ask what lessons the Agency has learned, nor does it ask what lessons states have learned. In this last regard, if states draw on their experiences with the IAEA in considering a possible chemical weapons verification agency, they could well learn and seek to apply lessons of a very different character from those offered here, or those that the Agency itself might have learned. Thus, the analysis and lessons of this study cannot be considered as definitive or complete. They are at best indicative and heuristic from one perspective — that of an independent academic observer.

Part 1. Some General Considerations

The IAEA is generally regarded as successful in its function of safeguarding peaceful nuclear activities in states. That a safeguards system could be created in this sensitive area, could employ such intrusive techniques as routine on-site inspection, and could be regarded (despite some limits, defects and criticisms) as effective, all provide one initial, fundamental lesson: that such a system is not inherently infeasible. In appreciating the nature of this success, and in suggesting its lessons for other areas of arms control, one should be aware not only of the ways in which the Agency has carried out its tasks but also of the limits of its efforts, and of the conditions under which it operates.

The first part of this study will examine some general considerations affecting the Agency and how these could bear on chemical weapons verification by an international agency employing inspection as a primary verification technique. It will focus its discussions on several questions: What does the Agency do? How has it defined its objectives and the problem to be dealt with? How broad is its threat coverage? How successful has it been, given the limitations of its techniques and resources and the limits of its coverage? What environmental conditions have assisted the Agency? What issues arise from the use of an international organization as a verification agency?

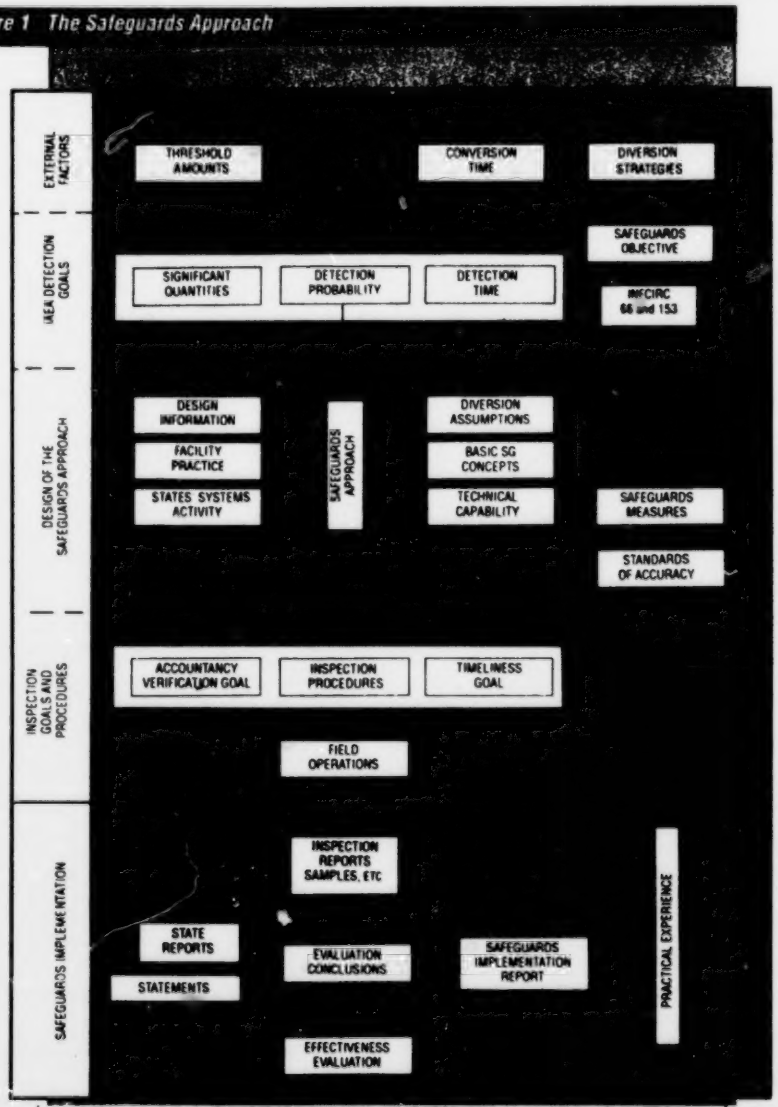
What Does the Agency Do ?

Objectives and Problem Definition

As stated in Article II of its Statute, the Agency "shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose." This objective, it should be noted, does not involve disarmament (the reduction or elimination of a certain class of weaponry) but rather non-proliferation (preventing the further spread of a class of weapons). Although its controls are applied to nuclear production systems (the nuclear fuel cycle), they are directed at controlling the end-use of nuclear materials and facilities rather than at the acquisition of fuel cycle facilities and nuclear materials as such. Its safeguards are applied to civilian nuclear material and facilities to deter, through a high risk of detection, diversions of nuclear material to proscribed or (as stated in INFCIRC/153) unknown purposes.

If a chemical weapons agreement removed existing stocks of chemical weapons and associated production facilities, as well as guarded against future production, it would be both a disarmament and a non-proliferation agreement.

Figure 1 The Safeguards Approach



The safeguards approach is defined as the system of nuclear material accountancy, containment, surveillance and other measures chosen for implementation of safeguards in a given situation; the system is developed to satisfy the safeguards objectives of that situation. In designing the system, a model safeguards approach is developed for each type of nuclear facility; this is then adapted to specific facilities for implementation. The general scheme followed in designing a safeguards approach is illustrated in the diagram.

Source: **IAEA Safeguards Glossary, 1980, IAEA/SG/INF/1, pp. 18-19**

This broader scope would reduce charges of inequity such as those that have arisen as a result of the disparity in the application of IAEA safeguards between nuclear weapons states and non-nuclear weapons states, under the Non-Proliferation Treaty. Those parties with major chemical weapons facilities and relevant chemical industries presumably would bear the greatest burden of safeguards. The broader definition of objectives in this case would strengthen the position of such a chemical weapons treaty, as well as of the agency carrying out the necessary verification activities. Since some chemical warfare activities for protective purposes would still be allowed, since the relevant chemical industry would be larger, more complex and more dynamic than the civilian nuclear industry, and since all parties would be subject to safeguards, the resource requirements of a verification agency under this sort of agreement would be larger than that required for an arms agreement exclusively intended to prevent proliferation.

With respect to the definition of the problems to be managed, Agency safeguards face certain difficulties which could be expected for a similar approach by a chemical weapons verification agency. IAEA safeguards are ultimately directed at preventing one particular end-use of identified facilities, materials and productive processes — for nuclear explosives. The Agency's safeguards approach must be able to distinguish conceptually between permitted civilian and military uses on the one hand and proscribed uses on the other, and to make this distinction operational in its safeguards systems. Monitoring an agreement based on end-use distinctions, because it permits the existence of activities requiring such monitoring, is likely to be inherently more difficult and intrusive than monitoring for the mere presence or absence of a capability. In a chemical weapons agreement, this kind of problem is bound to arise. Although some chemical agents, precursors, plant and technology may have only military purposes and would likely be proscribed under a chemical weapons ban, others have dual capabilities. As well, some military purposes (e.g., for the maintenance of a protective capacity against chemical weapons) may not be proscribed.

Another problem arises from this end-use approach. Nuclear safeguards try to preserve access to the benefits of peaceful nuclear technology while controlling its military uses. At least in the Agency, they do not address problems of "latent" proliferation — the spread of a mere technological capacity to make nuclear explosives. The existence of more than one definition of the proliferation problem— nuclear explosives per se versus a capacity to make nuclear explosives — and the Agency's focus on the narrower problem have had a variety of effects. First, it limits the assurances the Agency can provide through its safeguards. Second, it has led to efforts to pursue the broader definition of the proliferation problem outside the Agency. Third, it affects issues concerning transfers of nuclear goods and services. Each of these difficulties could be replicated for chemical weapons safeguards based on an end-use approach. Applying a latent proliferation approach to parts of the

Table 2

Some Key Definitions

Nuclear accountancy. The practice of nuclear material accounting by the facility operator and the state system of accounting for and control of nuclear material (SSAC) and, in addition, the verification of evaluation of this accounting system by a safeguards authority (SSAC or IAEA) with subsequent statements of results and conclusions which make it possible to determine the degree of assurance provided by the safeguards measures. Accountancy includes activities such as the following.

At the Facility Level:

- Dividing nuclear material operations into material balance areas (MBAs).
- Maintaining records describing the quantities of nuclear material held within each MBA.
- Measuring and recording all transactions involving the transfer of nuclear material (international or domestic) from one MBA to another or changes in the amount of nuclear material present due to nuclear production or nuclear loss.
- Periodically determining the quantities of nuclear material present within each MBA through the taking of the physical inventory.
- Closing the material balance over the time period spanned by two successive physical inventories and computing the material-unaccounted-for (MUF) for that period.
- Providing for a measurement control program to determine accuracy of measurements and calibrations and correctness of recorded source and batch data.
- Testing the computed MUF against its limits of error for indications of undetected loss.
- Analysing the accounting data to determine the cause and magnitude of mistakes in recording, unmeasured losses, accidental losses and unmeasured inventory (holdup).

At the SSAC Level:

- Preparing and submitting accounting reports to the IAEA as appropriate.
- Ensuring that the accounting procedures and arrangements are correctly adhered to.

continued...

Table 2 continued

Some Key Definitions

- Providing for inspector access and co-ordination arrangements as necessary to enable the IAEA to carry out its verification activities.
- Providing for independent verification by the SSAC of facility operators' safeguards performance, as appropriate.

At the IAEA Level:

- Independently verifying nuclear material quantities and locations, using inspection methods such as examination of accounting records and comparison with accounting reports, item counting and identification, independent measurements, verifying the operation and calibration of instruments and other measurement and control equipment, verifying information on possible causes of MUF, of shipper/receiver differences and uncertainties in the book inventory, and carrying out other activities as provided for in the safeguards agreement.
- Determining the effectiveness of the SSAC.
- Providing statements on the IAEA verification activities to the State.
- Providing statements for the annual safeguards implementation report (SIR) for the Board of Governors on the effectiveness of IAEA safeguards.

Containment. Physical barriers, e.g., walls, transport flasks, containers, vessels, etc., which in some way physically restrict or control the movement of, or access to nuclear material, to information related to the quantities or locations of nuclear material, and to IAEA surveillance devices.

Surveillance. The collection of information through devices and/or inspector observation in order to detect undeclared movements of nuclear material, tampering with containment, falsification of information related to locations and quantities of nuclear material, and tampering with IAEA safeguards devices.

Inspection. A set of on-site IAEA activities to verify that the way in which nuclear material, equipment or facilities subject to safeguards are used complies with the provisions of the agreement. The activities may include the review of design information to ensure that safeguards can be effectively applied, the examination of records of nuclear material and comparison with the corresponding statements by the State to the IAEA, inventory and flow verification, the installation and servicing of containment and surveillance devices.

Source: IAEA Safeguards Glossary, 1980, IAEA/SG/INF/1, pp. 28-29, p. 50 and p. 55.

chemical industry, however, may be very difficult because of the widespread availability of chemical plant and materials.

The IAEA has never used the broader definition of the proliferation problem (i.e., the spread of the capacity to make nuclear weapons). Its dual objectives of providing assistance as well as safeguards tend to rule such a broader definition out. Moreover, the Agency's composition and political functioning would probably not allow it to develop or sustain such a definition. Instead, both in general and within the NPT, attempts to control the spread of nuclear weapon-making capacity have been led by certain supplier states and have largely occurred outside the Agency, which has been used as a channel of communication to recipient states. These supplier efforts have been a source of strain in the non-proliferation regime, being seen by some (including some suppliers as well as recipients) as reneging on supply obligations. Supplier policies outside of or in addition to Agency safeguards can strengthen controls by filling gaps in the Agency's mandate and powers. However, they can also be seen to limit legitimacy of the Agency as a verification body.

The definitional problems of proliferation can encourage undesirable supply-safeguards linkages and the development of additional functions in a monitoring body. In the nuclear field, although safeguards are a condition of supply, the linkage now seems to be reversing: states want assurances of access in return for accepting safeguards burdens. If there are no access advantages that follow from accepting safeguards, the attractiveness of safeguards is diminished. The Agency has only limited advantages it can offer in its technical assistance, and it is not clear whether parties to the NPT have access advantages relative to non-parties. Such linkage issues could develop in a chemical weapons regime.

The Agency's experience also raises the possibility that a verification agency could be given a role in the supply of assistance. It could be argued that such a function could encourage membership in the agency, and if membership implied accepting safeguards (it does not in the IAEA) it would support the achievement of an agreement's arms control objectives. However, such a function would also have other effects on the structure, operations, politics and financing of such an agency, as the experience of the IAEA demonstrates. The two main Agency functions of safeguarding and providing technical assistance create competing objectives, serve different constituencies, and thus blur the Agency's identity and the criteria for its evaluation. They also increase the level and diversity of resources needed by the Agency. The distribution of resources between safeguards and technical assistance has been the subject of disputes in budget and policy debates. Similar effects could be expected for a chemical weapons verification agency if it had an assistance function. It would seem broadly desirable, therefore, to have a verification agency performing a single, well-defined task, with any other functions assigned to it clearly secondary and supplementary to that primary task.

Transfers of plant, materials and technology could also be important in a chemical weapons ban. Requiring safeguards as a condition of export could readily become entangled with demands for technical assistance as a price for adherence to an agreement. In addition, expressly limiting or prohibiting transfers of highly specialized materials or technology from the start would present problems of identifying such items, and would still leave the problem of dual-use items. Such a limitation, however, would possibly help to establish a latent proliferation principle, and could be of importance if transfers were a recurring issue.

"Threat" Coverage

A verification agency must provide appropriate assurances that all parties are complying with their obligations under a treaty. The NPT, however, does not mandate the Agency to verify that all possible routes to acquiring nuclear weapons are renounced by the parties. Also, some routes to acquiring nuclear weapons that are within the purview of the Agency's mandate to verify are not fully covered because of resource constraints.

The Agency's definitions of both its problem and its relevant tasks immediately limit the range of possible routes to acquiring nuclear weapons or the "threats" it covers. Even if its systems are quite adequate in some areas of concern, they may be only partially relevant in others. The implications of an end-use problem definition have already been noted. As for specific tasks, the Agency's systems are intended to deter diversions from safeguarded nuclear activities to proscribed activities. Clandestine production or stockpiling are not directly dealt with by the Agency, nor does it have a mandate to seek out such production or stockpiles. Some routes to nuclear weapons — possibly the more likely routes — are therefore left uncovered.

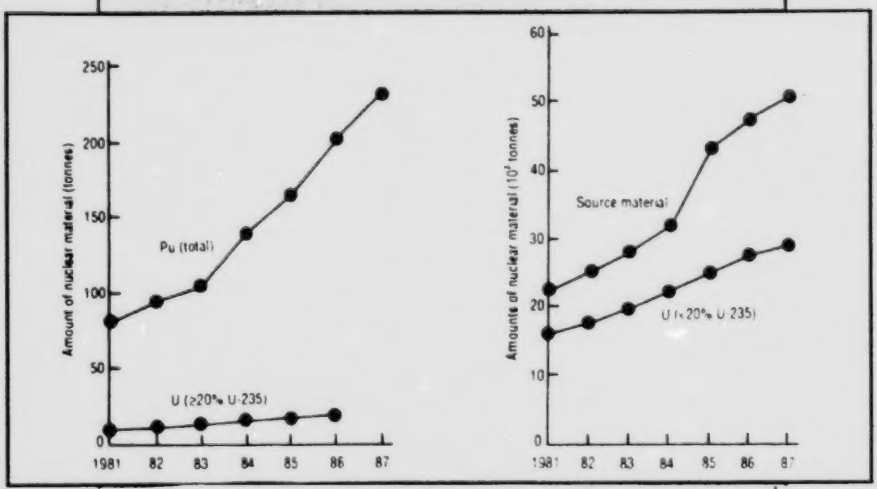
The Agency's relevance is also affected by the differences between its two safeguards systems. Although the NPT-associated INFCIRC/153 system is widely applied, a number of highly significant states are not covered by it: as of the end of 1985, 11 of 53 states with "significant nuclear activities" were under only INFCIRC/66 safeguards.[1] INFCIRC/66's proscription of "all military activities" is broader than the limits in INFCIRC/153 which deals with only certain military activities (i.e., nuclear weapons and other nuclear explosive devices). INFCIRC/66 has also been extended to include all nuclear explosives including those for peaceful purposes. However, INFCIRC/66 is applied to specific items, not on the full-scope basis of the NPT system. Thus, it permits states to have legitimately unsafeguarded activities. This difference arises from the history of safeguards: the INFCIRC/66 system was developed before the negotiation of the NPT. At first glance, it would seem that this problem of differences between safeguards systems, arising as it does from the unique history of the IAEA, could be avoided in the negotiation of a chemical weapons

convention. However, it could arise through another route: safeguards over transfers from parties to non-parties. Such transfers under the NPT may carry either full-scope or item-specific safeguards requirements, but this is a matter of national policy of the supplying state. Avoiding two separate systems under a chemical weapons convention would seem desirable, but would require that a safeguards system equivalent to that applied to parties also be applied to non-parties. Otherwise, one can foresee two safeguards systems developing: an item-specific system for non-parties and a full-scope system for parties.

Another gap in the IAEA's coverage at this general level relates to motivations for the acquisition of nuclear weapons or of nuclear weapons capabilities. While the Agency's safeguards reduce certain pressures for such acquisition which can arise from fear or suspicion of the nuclear activities of other states, it leaves some other basic motivations untouched. Regional or global ambitions, objections to the perceived "protected" status of current nuclear weapons states, conventional security fears, etc., are not addressed by the Agency's verification activities. Since these concerns touch on fundamental issues of power and security, it is not surprising that the Agency is not directly involved in them. The Agency addresses the defensive fears of non-proliferating states or of some reluctant proliferators rather than the motives of states seeing some positive advantages in proliferation. It does not address the question of which proliferators might be most dangerous.

This gap affects the Agency's systems in a significant way. Because of it, as well as the Agency's use of a non-discriminatory system to the extent possible, the allocation of safeguards efforts is made according to "objective" technical/industrial criteria. The Agency's efforts are directed to states with significant civilian nuclear activities, not to states that may have the strongest motivations to acquire nuclear weapons or that might present the most undesirable consequences. There is thus a discrepancy between the distribution of the political risk of proliferation and the allocation of safeguards resources by the Agency. In particular, safeguards may be applied to states which, for all their nuclear technology, have little interest in "going nuclear," while more dangerous but less capable states get off lightly. This discrepancy seems inevitable, since a distribution of Agency efforts overtly based on assessments of motivation and consequences would probably be politically unworkable. Other verification agencies would seem to face the same problem unless they were organized on the basis of rivalries between states or alliances. An acceptance of a provision in a chemical weapons convention for compulsory challenge on-site inspections would go a long way to addressing this discrepancy between political risk and allocation of verification resources.

*Figure 2 Amounts of Nuclear Material under IAEA Safeguards**



* Including all safeguarded nuclear material in nuclear-weapon states.

Note: Data for plutonium refer to the total amount of plutonium, i.e., that contained in irradiated fuel and separated plutonium.

Source: V. Schuricht and L. Larrimore, "Safeguarding Nuclear Fuel Cycle Facilities", *IAEA Bulletin*, Vol.30, No.1,1988, p.9.

Agency Effectiveness

The effectiveness of Agency safeguards can be judged not only by the extent to which they cover all the possible routes that a state could take to acquire nuclear weapons, but also by the adequacy of safeguards where they do apply.

Only in recent years has the Agency attempted to apply safeguards to some sensitive portions of the fuel cycle, such as enrichment and reprocessing plants. In the past, these sorts of facilities have generally been concentrated in nuclear weapons states, so the gap in coverage was not great. In the case of chemical weapons, if the relevant capabilities were already widespread, such a pattern of the gradual extension of safeguards over the entire production process

would allow more possibilities of abuse. The application of a full system from the start would be preferable, or at least a phasing-in that did not leave uncovered critical production phases for controlled materials. Given adequate advance preparation, the evolutionary problems faced by such a system would then be those arising from new safeguards procedures, new industrial processes, and the possible extension of the system to cover new chemical agents or precursors.

The Agency's INFCIRC/153 system is based on the application of materials accounting methods at specific points in the nuclear fuel cycle (Key Measurement Points): flows into and out of a Material Balance Area (MBA) should only occur through such points and should correlate appropriately with physical inventories, with some allowance for operating losses, measurement errors, etc. These factors, and the possibility of diversions, will generate Material Unaccounted For (MUF), a difference between book and actual inventories for the MBA. Materials accounting is supplemented by surveillance and containment methods. Surveillance can help secure the boundaries of the MBA, monitor channels of movement between MBAs, and watch for unusual operations in a facility. Containment can package materials for easier counting, similarly help secure the boundaries of the MBA and monitor channels between MBAs, and also monitor the integrity of safeguards instruments through, for example, the use of tamper-indicating seals.

Specific types of facilities present difficulties for the IAEA systems, and in generic terms at least, these would probably be replicated in the chemical area. Safeguards on reactors are generally readily handled by item-counting materials accounting methods, supplemented by containment and surveillance, and by techniques of non-destructive testing (e.g., of fuel assemblies). Bulk-handling facilities are a problem, as a significant absolute quantity of MUF might be reached even for a small percentage of MUF relative to the throughput. Measurements may be more difficult for continuous or liquid flows as compared to movements of discrete items. Even increased emphasis on containment and surveillance methods can run into problems if there are parts of a facility which are difficult to monitor because of the inherent dangers of some processes or materials.

The general dependence on materials accounting has been acceptable because it can reduce the level of intrusion by safeguards. Specific sensitive areas and processes can be "black-boxed" by this methodology. Another advantage is that the information needed for materials accounting will overlap to some degree with the needs of state regulatory authorities and of facility operators. But stressing one safeguards methodology could be a difficulty if, despite its centrality, it is inappropriate or inadequate for some cases. States may be reluctant to permit changes in a safeguards system to allow the more extensive use of other methods.

Table 3

Growth of the IAEA

	TOTAL IAEA EXPENDITURES (actual obligations) ($US millions)	IAEA TOTAL STAFF	SAFEGUARDS			
			No. of Inspections	No. of Installations under Safeguards	Safeguards Division Expenditures ($US millions)	Safeguards Division Total Staff
1966	8.9	731	29	55	0.4	(24)*
1976	35.4	1232	565	332	5.9	138
1986	114	1994	2050	910	39.9	455

*Figure is for 1967
Source: Various IAEA documents

The Agency's ability to integrate findings across MBAs is another point of difficulty. If safeguards are applied only at the level of specific MBAs, there is some danger of "partitioning," that is, diversions of small quantities of material at a number of points. An integrated system based on an entire facility would permit cross-checking among MBAs. A system applied to a state's entire fuel cycle would allow cross-checking of shipments between facilities. Safeguarded shipments from one state to another would present similar possibilities on another level. At these last two levels, however, the information system needed to track these flows could be quite complex and difficult to develop. There are problems in inaccuracies, delays and incomplete reporting of such shipments in the Agency's systems, whether within or across states. The deficiencies in the reporting system, whether as designed or as performed, allow the possibility of collusion between a shipper and a receiver. Similar difficulties could be expected in the case of a chemical weapons ban. There is no doubt that measurement problems will be much more severe with respect to chemical production and transfers because of the much larger volumes of materials involved and the greater complexities of the chemical industry. An understanding of such problems and Agency efforts to deal with them in the nuclear field would be instructive.

It should also be noted that, for both nuclear weapons and chemical weapons production, the monitoring of other activities could be useful. Preparations for the use of chemical weapons, for example, would require specialized equipment, munitions and training for armed forces, the

development of doctrines and manuals, and incorporation of relevant units into the armed forces. Monitoring such activities is more likely to be the preserve of national intelligence-gathering agencies (which may also, of course, keep a watch on facilities). A chemical weapons verification agency conceivably could monitor this sort of indicator or could be restricted to production facilities. The utility of the Agency as a model for indicators beyond production facilities is, of course, much more limited.

Questions also arise concerning the IAEA's technical criteria for safeguards. The Agency is charged in INFCIRC/153 with the *timely detection* of diversion of *significant quantities* of nuclear material from peaceful nuclear activities (para. 28). These criteria vary with the character of the specific nuclear material concerned. The significant quantity criterion is roughly the amount needed, allowing for operating losses, to produce one explosive device per year. The timely detection criterion is "of the same order of magnitude" as the time needed to convert the necessary material to a form suitable for an explosive device. There is also another criterion: the system must not only give confidence that diversions will be detected, but also that unnecessary false alarms will not be given. Unfortunately, measures taken to avoid false assurances will also increase the probability of false alarms. These criteria are political as well as technical in nature: they were created through a process of negotiation and reflect estimates of acceptable performance and risk. Analogous criteria would likely be appropriate for a chemical weapons convention, with an additional criterion or set of criteria according to which potential agents or precursors would be selected to be subjected to safeguards.

The Agency cannot yet meet the detection and false alarm criteria set for it. How this weakness should be interpreted is a matter of dispute. While some think of the criteria as setting safeguards standards, Scheinman argues that their real function is to set guidelines for planning, the distribution of safeguards efforts, and safeguards research and development. They must be further operationalized before the Agency can achieve benchmarks for the measurement of its performance. The Agency's concrete "inspection goals," considered attainable with existing technical means although not necessarily with existing resources, are a different thing, he says. So, too, are "accountancy verification goals," which concern the minimum material diversions which the Agency would seek to detect, bearing in mind the desirability of avoiding false alarms. Notes Scheinman of these last: "They are the best the agency expects to do, given the type and throughput of a facility."[2]

Even for these adjusted goals, the Agency's performance is still substantially less than perfect. Noted Grumm in 1983:

> *In the late 1970s, the quantitative goals set by the Agency could be attained only in the case of a rather small number of facilities. However, over the past four years the number of inspected facilities has increased by over 50% and the cases where the IAEA has fully attained its inspection goals have increased from 17% for the facilities inspected and from 45% to 70% with respect to the direct-use nuclear material in these facilities. In many more cases the goals were partially attained, covering the more attractive diversion paths.*[3]

Resource limitations likely account for some of this gap between standards and performance. The Agency, for example, has determined Maximum Routine Inspection Efforts (MRIE) for various facility types, and sets Actual Routine Inspection Efforts (ARIE), at a lower level; however, it is unable to generate the required ARIE with its available personnel.[4] Quite clearly, however, other technical factors are also at work. Merely increasing Agency resources would not result in technical perfection.

Scheinman also points to another problem: measures of safeguards efforts, in terms of ARIE or actual inspection efforts, are not the same as measures of safeguards effectiveness, even though it might be tempting to confuse the two.[5]

Given the various limitations on the Agency's safeguards systems, even defining, let alone assessing, what one means by "Agency effectiveness" becomes difficult. Every year the Agency detects a number of anomalies (on the order of a hundred or more). These may arise from causes other than diversion, and the Agency regularly states that it has no reason to suspect that diversion has occurred.[6] Given the limitations of the Agency's systems, should this number be reassuring or troubling in its size, and how much assurance should states derive from Agency statements?

The limited functioning of the Agency's systems points to an important lesson: a safeguards system need not be complete in its coverage or "perfect" in its technical performance to be adequate. This may be true for two reasons. First, states may be satisfied with a level of performance commensurate with the perceived risks within the area covered by the safeguards. Second, a potential proliferator may be deterred by a less than perfect risk of detection. These reasons in turn suggest a more complex explanation. One could argue that the Agency's efforts are useful in three specific ways.

First, Agency activities may reduce "background noise." For most states with nuclear technology, the likelihood of "going nuclear" is probably quite small despite the concerns which others might have. Factors other than technological capability are at work, so such states present low or moderate risks despite the very threatening nature of nuclear weapons. In the case of these states, even limited or imperfect assurances may be sufficient. Moreover, safeguards provide an approved and standardized mechanism by which these states can express

their good faith. The Agency's systems therefore may be effective in covering easy cases.

The second way in which safeguards are useful is to complicate the plans of potential proliferators. Safeguards create a risk of detection if certain proliferation routes are used and cause added trouble and expense if efforts are made to circumvent them. Subscribing to safeguards presents the proliferator with a legal obligation which must be violated or conspicuously terminated. If it withdraws from safeguards, it draws attention to itself; if it violates them, it bears the additional political burden if caught.

The third way in which safeguards are useful applies to states which avoid safeguards. Doing this highlights their lack of solidarity with the international community. They identify themselves as potentially worth increased national watchfulness at least, and possibly as the focus of efforts by other states to bring them into the safeguards regime.

Where defects in safeguards are concerned, but more generally where there are significant limitations on safeguards in terms of threats covered, there is room for both national and international monitoring. The IAEA should not be seen as the sole performer of monitoring functions, but rather as one body among many. Many states are not likely to be willing, as a matter of choice, to rely exclusively on an international body for verification of obligations with respect to militarily significant weapons. If a state were faced with a reassurance from the international body and a warning from its own monitors, it would at least be uneasy. Should the international body have effective challenge verification provisions its credibility might be strengthened, but never complete. Even in respect to challenge inspections, national monitoring capabilities would be desired as one means of generating the challenges. For states with relatively capable national monitoring agencies, the international body would be supplementary or secondary, even though it might have better access to some information. If both sources gave reassurances, the international body might seem somewhat redundant (certainly for states with high national monitoring capabilities), but this redundancy could be a virtue. National and international monitoring systems could be used to complement, if not reinforce, each other.

The Political Base

A safeguards system must have a political base that promotes the adherence and co-operation of states. In the case of nuclear safeguards, two elements of this base are supplier power and the existence of a broad norm or presumption against the spread of nuclear weapons.

Supplier Power

Both the principles and the practices of safeguards were initially established through a network of bilateral interstate nuclear co-operation agreements. The IAEA is to a great degree the heir to this network. Thus, historically, the development of safeguards owes a great deal to the willingness and ability of the suppliers of nuclear goods and services to require safeguards as a condition of supply. A chemical weapons verification body will profit from the historical development of safeguards in the nuclear area, but would be less directly dependent on a straightforward supply-safeguards linkage than the Agency has been. Nonetheless, certain aspects of the Agency's experience could be of relevance here.

Strong supplier support would be needed to create a strong regime of safeguards over relevant chemical industry exports, whether of materials, plant or technology. The prospect for supplier control is more difficult to assess in the chemical than in the nuclear area, as the chemical industry is more complex and widespread, and at least some sectors of it are more easily entered, than is the case for the nuclear industry. The variety of chemical agents and precursors that might be controlled, and the varying degrees or types of control to which they could be subject, are also sources of complexity. Even where the prospects for supplier control were good, however, too great a dependence on supplier control, without some efforts to develop a broader basis for political support, could lead to difficulties.

As the number of suppliers has increased in the nuclear area, so has the difficulty of co-ordination among them. This creates a danger that less demanding suppliers will undercut those who put stiffer controls on their exports. This problem has been exacerbated by differences among suppliers over the nature of the proliferation problem — differences that also exist between suppliers and recipients. An international convention or organization could serve as a co-ordinating mechanism, but such a potential has not been fully realized in the nuclear area. The Agency has at best been used for this in a limited fashion. The "trigger list" of items the export of which would require safeguards under the NPT was developed by a committee of major suppliers acting essentially outside the IAEA. It was never accepted by the Agency's Board of Governors, but rather was communicated to members of the IAEA.[7] Similarly, the Nuclear Suppliers Group (NSG) guidelines on technology transfer and other issues were developed outside the Agency, which served as a channel of communication. Certain key elements of the nuclear non-proliferation system, then, have been left up to states acting unilaterally or co-ordinating outside the Agency.

In defence of this limited use of the Agency, one can point to the low probability that such controls would have resulted if the Agency had been the forum of creation. Aside from a different definition of the problem, in the

Agency nuclear recipients would have had a much stronger political base. Political controversy and damaged legitimacy might have been the price for more effective controls and co-ordination. Attempts to reverse the supply-safeguards link, noted earlier, have been one result. Agency safeguards could be used by recipients as a protection against more extensive and rigorous supplier requirements – as both a ceiling on these and an implied guarantee of unimpeded access. Some suppliers, on the other hand, might regard them as a floor for safeguards and as subject to further considerations with respect to access. The Agency is thus either pulled in contrary directions or used as a mere channel for information on decisions reached elsewhere.

A detailed control system set out in a chemical weapons convention possibly could reduce or avoid many of these difficulties, by setting out clearly at the start the materials, plant and technology subject to controls, and what those controls would be. Parties would then be clear as to their rights and obligations, and resort to action by suppliers outside the verification body might be avoided. Four difficulties, however, would still possibly arise.

First, the problem of handling transfers to non-parties would have to be dealt with: should these also be detailed in such a convention, or should they be left up to individual exporters? Second, if demands for revisions of controls arise, there could still be a temptation for some states to work outside the treaty while others insist on staying within it: the problems, in other words, might be postponed but not necessarily avoided completely. Third, the relationship between the controls in such a convention and national policies would have to be addressed: would states be free to place additional conditions on transfers, or would the treaty's controls be an international maximum? Fourth, reliance on a convention-based set of controls without reference to safeguards based on bilateral agreements between suppliers and bilateral networks could have a cost. In the nuclear area these bilateral networks still exist and, in some cases at least, provide a safety net in the event the Agency is unable to carry out its functions. While the existence of bilateral agreements in the chemical area would complicate international control, preventing or replacing such a network would mean forfeiting this safety net.

The safety net argument presents some difficulties, though. If a state is determined to violate or to withdraw from its safeguards obligations, it is unlikely that merely an additional set of such obligations would have more than a marginal influence at best on its decision. Such a safety net is probably more useful for technical problems that could arise in the application of safeguards if a state leaves the international safeguards system for other reasons.

A Non-Proliferation Norm

The Agency's experience suggests the importance of a strong and broad consensus about both the general nature of the phenomenon to be controlled and the means by which this control is to be accomplished. Failure to achieve a consensus may produce possibly fatal strains within a control regime.

In the nuclear area, a crucial, if intangible, factor in nuclear safeguards is the existence of a broad, although not necessarily universal, presumption against the spread of nuclear weapons. The sense, however general, that nuclear weapons are not like other weapons, that they should be controlled, and that their spread would be neither desirable nor wise, should not be ignored as a factor in efforts to contain nuclear proliferation. Such a norm has a number of positive effects. It increases the likelihood of a negative reaction to proliferation, thus increasing the expected cost of a violation. It legitimates specific safeguards requirements, explaining in part the willingness of states to accept the intrusions represented by safeguards. The voluntary co-operation of states with Agency safeguards helps to make problems in their application more manageable. By reducing the fear of proliferation, it reduces the pressure on technically imperfect and limited safeguards systems. Where states are perceived to share this norm, their civilian nuclear activities may be seen as less threatening, tolerance for some ambiguity is increased, and the burden on safeguards is reduced. As for the Agency, such a norm may help protect it against intrusions of political issues extraneous to the safeguards function. The Agency has been relatively sheltered from such intrusions, compared to other international bodies; given the political importance of its activities, this should not be attributed solely to its technical nature.

Such a norm has its problems, however, some of which have already been noted. The definition of the objective, whether non-proliferation or disarmament, or end-use versus latent proliferation, is a continuing difficulty. Problems also exist in the implementation of the norm, whether in transfer controls or in perceived inequity in the distribution of the safeguards burden.

A chemical weapons control regime would gain from the general revulsion which surrounds these weapons. As in the nuclear area, the broad norm seems to present little problem; the real difficulties arise in the implications of implementation measures.

The Use of an International Organization

Although other international organizations engage in the verification of arms control agreements, the IAEA is probably the premier example of such a body. Its experience should reveal some of the implications of using such a body for verification tasks.

Standardization and Legitimization

An international verification organization can help to co-ordinate pre-existing safeguards systems, and to develop a standardized system. This has been the case with the IAEA. Co-ordination reduces the multiplicity of approaches, standards and mechanisms in safeguards systems. It eases the position both of recipients who may find themselves operating under two or more conflicting systems, and of third parties who will have to cope with assurances of differing types emanating from differing sources. For suppliers, it reduces the problem of undercutting by setting a floor for safeguards requirements. The uncertainty as well as the complexity generated by the existence of multiple systems is thus reduced.

As an aspect of standardization, we should note that, although the Agency may be requested to take on a safeguards function with respect to an interstate agreement, it does not seem obliged simply to apply whatever system the state parties require. Its safeguards agreements must be approved by its Board of Governors. It has tried to apply broadly similar guidelines, whether under INFCIRC/66 or INFCIRC/153, which helps the Agency avoid being saddled with a more varied set of safeguards systems. This matter is of importance for the Agency in that mere membership in it is neither sufficient nor necessary for the application of safeguards. Under a chemical weapons convention additional safeguards submissions, by non-members, should be considered. In such a situation, an approach by a chemical weapons verification agency similar to that of the IAEA would seem useful.

A standardized safeguards system developed and applied through an international organization representing both suppliers and recipients also may have greater legitimacy and political acceptability than a bilateral system. It can be a benchmark for acceptable practices, protecting the interests of both suppliers and recipients.

Verification by an international organization may well be more acceptable as an intrusion on state sovereignty than if it is conducted directly by another state. Not only might the organization be seen as neutral, but also safeguarded states may believe that their interests are better protected in an organization over which they have some influence than in a one-to-one relationship with a supplier.

Such advantages have certain costs, however, some of which have been noted already. The assurances given by an international agency may be less credible than those of a bilateral system, precisely because the latter could be more demanding. The agency's system would reflect an international consensus that amounts to an acceptable common denominator, one which may involve sacrificing some effectiveness. The international agency will probably not adopt overtly discriminatory criteria in assessing risk of potential violations, and thus there might be a mismatch between the distribution of the safeguards burden and the distribution of the political risk. While suppliers might view its safeguards as a floor, recipients might view them as a ceiling. In addition, updating the system to adapt it to changing needs, technology (including safeguards technology) and perceptions of the problem could be difficult in an international organization, since the members must agree to these updates. If the agency's verification system were specified in some detail in a convention, the problems of modifications, reservations and limited acceptance of amendments would have to be faced. These would be particularly pressing in a dynamic industry or if the convention's coverage was meant to be extended to additional agents and precursors, or if additional safeguarding approaches became necessary or desirable.

Such difficulties could create pressures for the generation of more safeguards systems, within the organization or outside it. Maintaining the coherence of the organization's system and the centrality of the organization in the overall verification regime could thus be long-term problems. Assuming that the chemical weapons treaty had a disarmament aspect, however, as well as a non-proliferation aspect, one problem faced by the NPT safeguards system would be avoided: the existence of two classes of safeguarded states under the convention, those with the weapons and those without.

Relations with Other International Organizations

More than one international body may have verification functions in the same issue area. The IAEA has faced this situation particularly with the European Atomic Energy Community (EURATOM), which performs verification functions, among other tasks, among the states of the European Community. The Agency has a co-ordinating agreement on verification with EURATOM, but the relationship has been a sore point not only with the states of Eastern Europe (which have objected to "self-inspection" in the negotiation of the NPT) but also with EURATOM and the European Community states themselves. Since its verification role is one of the few areas in which it has retained a significant function, EURATOM has been reluctant to surrender this task to the IAEA. The working out of an arrangement between the two bodies has created some difficulties as well because of differences in the nature of their safeguards systems and in their powers. The negotiation of a co-ordinating agreement to preserve EURATOM's function and serve the IAEA's NPT purposes, yet try to avoid unacceptable duplication, delayed the ratification of the NPT by

EURATOM members. A form of chemical weapons verification system exists within the Western European Union, and the relationship between this and a verification agency with an overlapping geographic scope would have to be considered.

Another example of overlapping jurisdictions is found in the Latin American nuclear weapons free zone. The Treaty establishing this zone (the Treaty of Tlatelolco) and the associated verification organization (OPANAL - Organismo para la Proscripcion de las Armas Nucleares en America Latina) also differs from the Agency in its safeguards requirements (e.g., it permits challenge inspections). However, the Treaty assigns a role to the IAEA as the verifying body and in respect to challenge inspections. This sort of arrangement could be studied for possible implications for a chemical weapons verification body. It offers one model of co-ordination, or even of the adaptation of the broader agency's function and system to local conditions. As well, since the Treaty has challenge inspection provisions in which the Agency could have a role, these should be investigated more closely.

The IAEA is an autonomous agency within the United Nations system. Although it submits reports to various UN organs, and should consider resolutions relating to its activities passed by those organs, it is not subordinate to those organs in the sense of receiving instructions from them. This is a very advantageous autonomy, since it helps to insulate the Agency from outside political forces which could damage its safeguards functions. If a chemical weapons verification agency is to have some relationship to the United Nations system, the nature of the Agency's relations and their possible applicability to such a verification agency should be explored.

Some Side Benefits and Costs

The beneficial activities of an international verification body need not be restricted to the mere issuing of reports of compliance or non-compliance. The IAEA serves as well as a forum for the discussion of issues associated with safeguards and nuclear affairs.

Some benefits could derive from the existence of a forum to take up issues related to anomalies uncovered by the safeguards system. Clear violations of obligations may be unlikely; the first warnings would probably come in the form of ambiguous situations. In the process of taking up an anomaly in its safeguards reports, the IAEA may require clarifications, explanations, and possibly remedial action by the state concerned. It thus provides a mechanism for the identification and resolution of troubling cases before these progress too far or develop difficult political ramifications.

There is always the danger, however, that as higher political organs are drawn into such deliberations, the formal finding of a violation will have political consequences which could lead some states to seek and others to avoid such discussions. The Board of Governors ultimately exercises the Agency's powers to investigate anomalies, and to make a finding of non-compliance. The combination of legal, political and technical considerations that would lie behind such a finding would affect the interpretation by specific states placed on statements by the Board. Commenting on the implications of political shifts in the Board, Fischer and Szasz note:

> *If the need should ever arise it might become increasingly difficult to obtain a finding of non-compliance against a member of a large bloc – or too easy to do so in the case of an isolated, unpopular country.*[8]

Such a risk, however, should not be overstated, in their opinion. In this context, there have been suggestions that such findings should be treated as technical matters and relegated to a lower, presumably more technical, level of the Agency.[9] The benefits and feasibility of this may be doubtful, however. On technical grounds alone, some anomalies may indeed be filtered out as trivial, but a purely technical approach with very stiff standards could create needless false alarms. It is a naive hope that anomalies that survived such an initial technical filter could be taken up in the Agency without reference to political implications. The concern underlying this suggestion, however, is valid: in any organization, some political considerations may detract from the performance of its functions. On the other hand, organizations function in a political context that makes their existence and working possible. Assuming that politics is only a disruption and that "technical" approaches and criteria can avoid politics shows a failure to appreciate this fact.[10] The challenge is to find a formula that will minimize extraneous political considerations.

Some aspects of this sort of problem, such as the composition and powers of the main Agency organs, membership, financing, and personnel policies, will be dealt with in the second section of this study. For the moment, only one broad matter will be touched on: the evolution of the organization.

All organizations are affected by developments in their environment. The spread of nuclear technology, the increase in the number of states in the international community and the rise of the Third World have forced the Agency to adapt. These have affected the strength and the identity of constituencies within the Agency, and how specific issues have been approached as a result. The balance between safeguarding and other functions, the composition of the staff, and the composition of the Board of Governors have also been affected. While these changes have not necessarily compromised the safeguards function, they have affected it, and may create difficulties in the future. Although it is to some degree a distortion, the idea that the Agency has been subject to an increasing "politicization" is a sign of the problem. The response has been concern over the changing character of representatives and of procedures on the

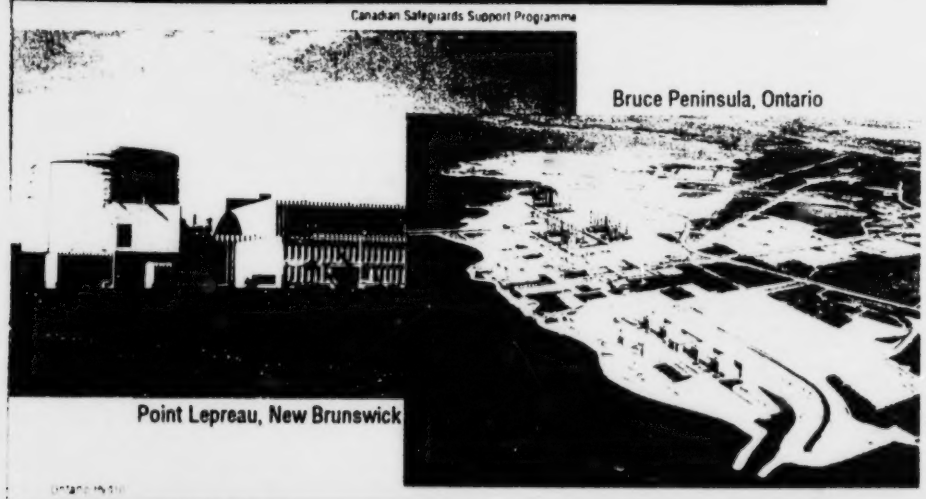
Board (not just its changing composition),[11] as well as concern about whether the Board will continue to take a leading role in safeguards issues.[12]

A chemical weapons verification agency could be spared some of the adaptation problems of the IAEA, but would have to operate in an environment similar to that now faced by the Agency. Whether or not it would face some of the attendant constraints depends to a great extent on the character and strength of the specific political environment, and on the ability of a chemical weapons convention to generate and maintain a strong consensus. Such a convention would have to be drawn up in a more complex environment, both technically and politically, than that of the Agency's Statute (or even the NPT), and thus might be more constrained. The development of blocs within the IAEA (there have been Eastern and Western blocs, but the Group of 77 is now important) would possibly be replicated within a chemical weapons verification agency, particularly if chemical industry transfers were significantly affected by it.

Notes

1. IAEA, *Annual Report for 1985*, GC(XXX)/775, pp. 60, 71.
2. L. Scheinman, *The International Atomic Energy Agency and World Nuclear Order*, (Washington: Resources for the Future, 1987), pp. 166-167, quoted p. 167.
3. H. Grumm, "IAEA Safeguards: Status and Prospects," in IAEA, *Nuclear Safeguards Technology, 1982, Vol. I*, (Vienna: IAEA, 1983), p. 9.
4. *Ibid.*, p. 10.
5. Scheinman, p. 233.
6. In two cases, however (one being Pakistan's KANUPP reactor), the Agency was for a time unable to verify compliance. See D. A. V. Fischer and P. Szasz, *Safeguarding the Atom: A Critical Appraisal*, (London: Taylor and Francis, 1985), pp. 16-17.
7. Benjamin N. Schiff, *International Nuclear Technology Transfer: Dilemmas of Dissemination and Control*, (Totwowa, N.J.: Rowman and Allanheld, 1983), pp. 142-143.
8. Fischer and Szasz, p. 94.
9. E.g., M. F. Imber, "Arms Control Verification: The Special Case of IAEA-NPT 'Special Inspections,'". *Arms Control*, Vol. 3 (December 1982), p. 69.
10. Whether or not an issue is "politicized" in the sense of becoming subject to "extraneous" concerns depends on one's definition of the issue. Thus, complaints of politicization could reflect as much loss of control over the agenda as anything else. In another sense of "politicized" – being concerned with political issues – the IAEA has always been political.
11. Scheinman argues, for example, that the Board was long dominated by personnel from the "atomic energy community," but these have now largely been replaced by "a new generation which in many states are drawn from the ranks of those who reflect the kind of thinking that now dominates the United Nations General Assembly and whose principal concerns are voting majorities, national secretariat quotas and technical assistance." United States, Congress, House of Representatives, Committee on Foreign Affairs, Subcommittees on International Security and Scientific Affairs and on International Economic Policy and Trade, *The International Atomic Energy Agency (IAEA): Improving Safeguards*, 97th Cong., 2nd Session, 1982, p. 58.
12. Fischer and Szasz, pp. 95-97.

Figure 3 Nuclear Power in Canada



Darlington, Ontario

Pickering, Ontario

Canadian scientists have been involved in the use of nuclear energy from the beginning of the nuclear age. Today, 18 nuclear power reactors operate in Canada using a unique Canadian design—the CANDU (Canadian-Deuterium-Uranium). Four more reactors at Darlington, Ontario, are currently under construction. Some of these reactor sites are illustrated here.

The success of the CANDU reactor is demonstrated by the fact that no less than seven of the top* ten power reactors in the world, as of 31 December 1987, are CANDUs.

*"Top," in terms of lifetime world power reactor performance for reactors over 500 MW. (Source: Nuclear Engineering International)

Figure 4 Canada's Chalk River Nuclear Laboratories

Canada has long recognized that the IAEA must have effective safeguards techniques and the active co-operation of member states. As both a user and an exporter of nuclear power reactors and nuclear materials, Canada also accepts an obligation to assist the IAEA in the development and application of effective safeguards. To supplement the resources of the IAEA with respect to overcoming deficiencies in the technical measures for applying safeguards, the Canadian Government initiated in 1977 a safeguards research and development program.

The Canadian Safeguards Support Programme is a co-ordinated effort for the development and the application of safeguards instruments and techniques for nuclear facilities and materials. The projects undertaken are those requested by the IAEA, which is involved at all stages. The program encompasses research, development, and applications engineering. Much of the work under this program is undertaken at the Chalk River Nuclear Laboratories. This facility is operated by Atomic Energy of Canada Limited which jointly administers the Canadian Safeguards Support Programme with the Atomic Energy Control Board of Canada.

Part 2. Some Specific Considerations

The preceding part of this study examined some general factors in the operations of the IAEA which could be relevant to a chemical weapons verification agency. This part looks at a variety of more specific considerations relating to the details of the IAEA's operations. It is divided into three sections: (1) the Agency's relations with states, (2) the internal functioning of the Agency, and (3) the safeguards systems considered in more technical and detailed terms. It should be noted that these distinctions are somewhat arbitrary for at least some issues.

IAEA Relations with States

Safeguards, Membership, Functions and Financing

Safeguards are paid for out of the regular budget of the IAEA. The financing of safeguards is complicated by two factors: the Agency's membership policy and the multiple functions of the Agency.

Membership in the Agency is neither sufficient nor necessary for the application of safeguards: the Agency derives its safeguards mandate from other sources (e.g., as a condition of its assistance, through unilateral submission by a state, under the terms of a multilateral agreement, etc.). A distinction may be made, however, between members and non-members in allocating safeguards expenses. Under INFCIRC/153, the Agency and members each bear their own expenses, while complete reimbursement of Agency expenses is normally expected of non-members. There is thus a mild financial incentive for a state to become a member. While it might seem natural and obvious for a verification body created by a chemical weapons convention to apply its verification activities only to members, the possibility of other arrangements should be noted and their implications considered (whether financial, as here, or in terms of the character of safeguards applied).

A more significant problem in financing safeguards stems from the multiple functions of the Agency. The Agency's technical assistance and safeguards functions have different priorities among its members. The growth of the safeguards budget relative to that for technical assistance, as the Agency's verification activities developed under the NPT, has been an ongoing source of political contention. That technical assistance is paid for by voluntary contributions while safeguards form part of the Agency's regular expenses is also an issue. Various devices have been used to dampen this controversy. Voluntary contributions to technical assistance have been increased as a quid pro quo for increased safeguards expenditures. Extrabudgetary contributions to

safeguards, for example as cash and in-kind contributions to research and development expenses, have helped to hold down the official safeguards budget. More significantly, the financing of safeguards has been placed under a special regime, in which 36 states pay 98 per cent of the expenses. This reflects, in part perhaps, the principle that richer states should pay more, but it also reflects the greater interest of some states in the Agency's safeguards activities.

Both the special financing regime and the use of extrabudgetary contributions present problems. Although one might say that safeguards serve the whole community, the special funding provisions, argues Schiff, reinforce the perception of safeguards as the concern of a particular constituency.[1] The specific problem of dual constituencies in a chemical weapons verification agency could, of course, be overcome by restricting the functions of that body to verification alone. More generally, the IAEA's problems with financing safeguards points to the need for a strong agreement not just on the functions of an agency but also on the principles for its financing.

Extrabudgetary contributions may be a response to the particular politics of safeguards financing, but they have broader implications for safeguards as well. Their use suggests the Agency's resource weakness — in financial, personnel and research terms — as compared to the resources of major states and other actors in the nuclear sector. It must co-operate with these other actors, as must be expected and as is healthy, but it may also depend on them for information and assistance. Reliance on extrabudgetary contributions merely underlines such dependence. As a result, the Agency could be affected in its various support services for its safeguards operations by what these contributors believe should be the main areas of effort.

A chemical weapons verification agency would probably face difficulties imposed by the parsimony of major contributors and by its connection to the chemical industry: it would not have the base needed to be fully independent of states in devising safeguards in response to changing conditions and technology. If the chemical area is more dynamic than the nuclear area, an agency would be even more dependent on close co-operation, outside help and thus outside judgements.

Personnel Policies[2]

An international verification organization must have a staff which can on the one hand operate with freedom from crippling national interference yet on the other retain the confidence of states. Some of the personnel problems that may arise are addressed here, as being linked directly to state-Agency relations, but others are dealt with below.

The Agency staff operates on the principle of an international civil service, that is, as an organization whose staff is primarily loyal to it and not to their nations of origin. This is not the only possible model: personnel could be treated as representatives of their governments. This approach could possibly work in a regional context, or if those states subject to safeguards were divided into different alliances. The adoption of this approach would rule out a perception of an agency as neutral, but such a view would not necessarily be undesirable. An agency's credibility, for example, could benefit if the members of one alliance knew that their people were inspecting their rivals. As the numbers and diversity of states and groupings increased, however, this model of organization would probably become less acceptable.

The concept of an international civil service requires that states resist the temptation to give instructions to nationals on the staff, and that nationals refuse to seek instructions from home states. The actual functioning of these principles will depend not only on the willingness of states to resist temptation but also on the ability of upper-level management to resist state interference in the Agency's personnel policies. The Agency may suffer from the normal personnel problems facing international organizations generally, but it seems to have escaped their worst effects, with benefits to its credibility. Since similar problems could be expected in a chemical weapons verification agency, the relevant personnel policies and practices of the Agency should thus be closely examined.

The "colonization" of upper-level positions by nationals of certain states is a problem in the United Nations Secretariat, and in some other specialized agencies. It reflects a natural tendency by major states and groups of states to seek representation in the upper ranks of the staff. Their ability to achieve this may increase the acceptability of the organization from their perspective, but it could create difficulties for the senior administrator of such a body, in terms of credibility and performance. An obvious problem would be that subordinate personnel would have power bases outside the agency, and states would have informal channels of influence by which they could bypass, negate or constrain the activities of the senior administrator. It is not clear to what extent colonization has been or is a problem in the IAEA.

A related phenomenon is that of "sponsorship." In theory, the IAEA hires individuals; in practice, these individuals must receive formal or informal sponsorship from their national governments. States thus have some potential control over which of their nationals shall be employed, again a possible factor in their acceptance of the Agency. This situation complicates Agency staffing by introducing additional personnel selection criteria. States may prefer to sponsor people for upper- rather than lower-level jobs, for example. It also creates a danger of state influence over individuals hired by the Agency, which can be exacerbated if personnel are recruited on a short-term basis and therefore have less opportunity to build a career with the Agency.

The use of geographic criteria for recruitment is also an issue. The professional staff of the Agency is overwhelmingly Northern and developed state in origin. The Agency explicitly subordinates geographic criteria to technical competence, and seems very largely to have succeeded in preserving this ordering as compared to other organizations. While there is a form of quota system, it seems to be applied only loosely. Third World pressures to increase their states' representation have been resisted with some success by other states, who are fearful of any decline in the technical competence of the Agency personnel. If geographic criteria were given greater weight, the Agency would have to strengthen its training program for safeguards personnel, but even then some deterioration would be likely.

Confidentiality and Transparency

The IAEA must meet potentially contradictory demands in its handling of the information acquired in its safeguards activities. It must observe limits on the information it seeks and on the handling of that information both internally and in its public statements, yet it must also provide sufficient information, including information on its own activities, to help maintain the credibility of its assurances. A chemical weapons verification agency would face similar general demands. Some aspects of the Agency's information practices, therefore, could profitably be examined.

Problems do arise in the handling of information in the safeguards process, but preservation of confidentiality does not seem to be a great difficulty. The Agency is specifically directed in INFCIRC/153 to seek only the minimum information needed to carry out its functions. This is reflected in the controls over its access to design information (it can review this information, but possibly only on state premises), and in the adoption of safeguards techniques. These permit states and plant operators to protect sensitive information. As safeguards are applied to individual facilities through supplementary arrangements and facility attachments, and through the information requirements for state systems of accounting and control, these various information restrictions are given specific operational forms.

Similar restrictions would probably occur in inspections of chemical industry facilities. It could be worth examining the detailed information requirements for this application as compared to the nuclear area, to see if they were comparable or if additional problems would arise in the chemical area. Given the problems that bulk facilities present for Agency safeguards, it might be worth considering the information requirements and implications of a greater use of containment and surveillance or other approaches. If the verification agency was intended to monitor more than just industry facilities, other indicators, monitoring activities and approaches would be required, and these could raise delicate issues in information acquisition and management.

The security procedures used to protect information within the Agency should also be examined. Agency personnel are directed not to reveal information they have received through their duties. However, Agency staffers may sometimes have contacts with the missions of their home states.[3] If difficulties have arisen through these or other contacts, they have either been fairly minor or kept from public knowledge. Such contacts might play a helpful role, for example in bringing earlier pressure to bear on a state to account for anomalies. On a more routine level, they can give states a better sense of how the Agency works, and thus increase their ability to evaluate its assurances accurately. But the potential for abuses which could seriously threaten the Agency is quite obvious. While some "informal transparency" could have advantages, good security procedures, staff loyalty, strong upper-level management and the willingness of states to refrain from destructive exploitation are all required.

Reports on inspections are normally only forwarded to the inspected state. In its public statements and published materials, the Agency gives only limited information concerning its findings or the nuclear activities of the states subject to its activities. Safeguards Implementation Reports, which assess the working of the safeguards systems, may give more information, but are considered confidential. This tight control over information has caused complaints by the U.S. Nuclear Regulatory Commission that it does not have sufficient information to evaluate Agency safeguards and assurances. Possibly more information could be released, with the effect of enhancing the credibility of the Agency's assurances. On the other hand, some information could readily be misunderstood or exploited for political (as well as commercial) purposes by states or by private parties, and the Agency's credibility could be undeservedly injured in the process. This was one reason for keeping the Safeguards Implementation Reports confidential.[4] Nonetheless, both the dissatisfaction with the information released by the Agency and the problems which improved access might cause should be noted as one area of possible study with respect to a chemical weapons verification agency.

Privileges and Immunities of Inspectors

The Agency's inspectors enjoy certain privileges and immunities in order to permit their effective functioning. These are covered in the Agreement on Privileges and Immunities, as well as in specific safeguards agreements. They include personal immunities, protection of baggage and communications, and the use of the UN *laissez-passer.* While inspectors may be expelled from a state, expulsions should occur only after consultations between the Director General and the Foreign Minister, and only for cases of abuse, not for official acts.

While there seems to be a general sense of satisfaction with this practice, difficulties may arise with respect to the movement of samples and equipment, and with the granting of multiple- versus single-entry visas. These practices could be explored more closely. A particular question might be how practices like these would be carried out under a regime of challenge inspections or when rapid access to a location was desirable. Whether and how such procedures might be strengthened and streamlined should be examined.

Field Offices

The Agency has two field offices, in Toronto and Tokyo. The development of field offices, whether they serve major clusters of safeguarded facilities in one state or in a region, helps the Agency achieve greater efficiencies in the use of personnel, since travel time to and from a central headquarters is reduced or avoided. Given the likely manpower constraints of a chemical weapons verification agency, it might benefit from a similar arrangement. The possibilities and the issues that might arise with respect to field offices should be studied.

The Designation of Inspectors

Inspectors for the Agency are appointed by the Director General with the approval of the Board of Governors, but they are designated for a specific state with the approval of that state, and the designations may be withdrawn. Difficulties with the designation process may affect the efficient use of manpower, at best, and at worst may damage the credibility of the Agency's assurances.

States may be slow in responding to suggested designations, thus delaying them and potentially delaying inspections. More generally, they may reject not merely individual inspectors but, informally, whole categories of persons because of language, nationality or other reasons. Or they may use their powers to limit the number of inspectors assigned to them. Most states put constraints on designations, and one result is that some inspectors are overused and others underused or even confined to headquarters. The Agency is unable to use all its inspectors everywhere, and so cannot deploy its limited resources in the most efficient manner. In addition, while one safeguarded state may find certain inspectors acceptable, others may regard them as less than competent.

The ability of a state to reject or withdraw acceptance of an inspector may be a necessary complement to its acceptance of inspection in the first place, but the Agency's experience also points to the costs — to it and possibly to the inspected state — of such discretionary power. It might be useful to study the Agency's designation procedures and problems more closely, specifically to see if some of these problems could be reduced or avoided through a revised procedure or through other Agency policies.

Constraints on Agency Safeguards Rights

The Agency's safeguards are applied through a chain of agreements with the safeguarded state, from the broadest agreement authorizing the application of safeguards, through an agreement on safeguards themselves, down to more detailed subsidiary and facility-level arrangements. In the process of operationalizing the safeguards through this chain, the Agency's safeguards activities become more specific than the general rights granted in the broad safeguards agreements. In some cases, this process may create additional constraints on the Agency's rights.

An example of this is found in the application of certain INFCIRC/153 safeguards agreements. Unlike the INFCIRC/66 system, which limits the Agency to a maximum number of inspections per year for various types of facilities, the INFCIRC/153 system applies limits to the number of man-days of inspection per year (the Maximum Routine Inspection Effort). In its subsidiary arrangements, the Agency will usually specify its Actual Routine Inspection Effort (ARIE), a smaller number. Japan and EURATOM have insisted on taking the ARIE figure as the actual maximum.[5] Since the Agency cannot produce even its planned ARIE, it is not clear that these constraining efforts materially affect its safeguards. The example, however, should be noted.

Sanctions

The IAEA has very limited sanctioning powers for a violation of compliance obligations. The Agency can end co-operation with a state in violation and suspend or expel it if it is a member. Its most effective sanction is the power to publicize — to report an inability to verify compliance to its members, to the United Nations, and to the world in general. Effective sanctions beyond this one depend on the reaction of the international community and of key states within it.

It is hard to imagine any verification agency realistically having more significant sanctioning powers than those of the Agency. It is, moreover, arguable that the enforcement function should be divorced from the verification function, the latter being primarily a process of collecting and assessing information. If non-compliance is detected, the more politically charged process of determining what to do about it then emerges. In the example of the Agency, an informal process of diplomatic pressure seems to operate effectively, as concerns about anomalies move toward the political level.

Dispute Settlement

The Agency has a general dispute settlement mechanism provided in its Statute, and also makes provision in its safeguards guidelines for the settlement of disputes arising out of its safeguards functions. Both of these provisions should be studied. A particular problem is how to preserve the ability of the Agency to obtain information, to draw conclusions and to act while also protecting the rights of states. This consideration could be important, especially for a regime of challenge inspections. Further, Fischer and Szasz point out that the dispute settlement mechanism has been used to impede the improvement of safeguards.[6] These general legal difficulties should be noted.

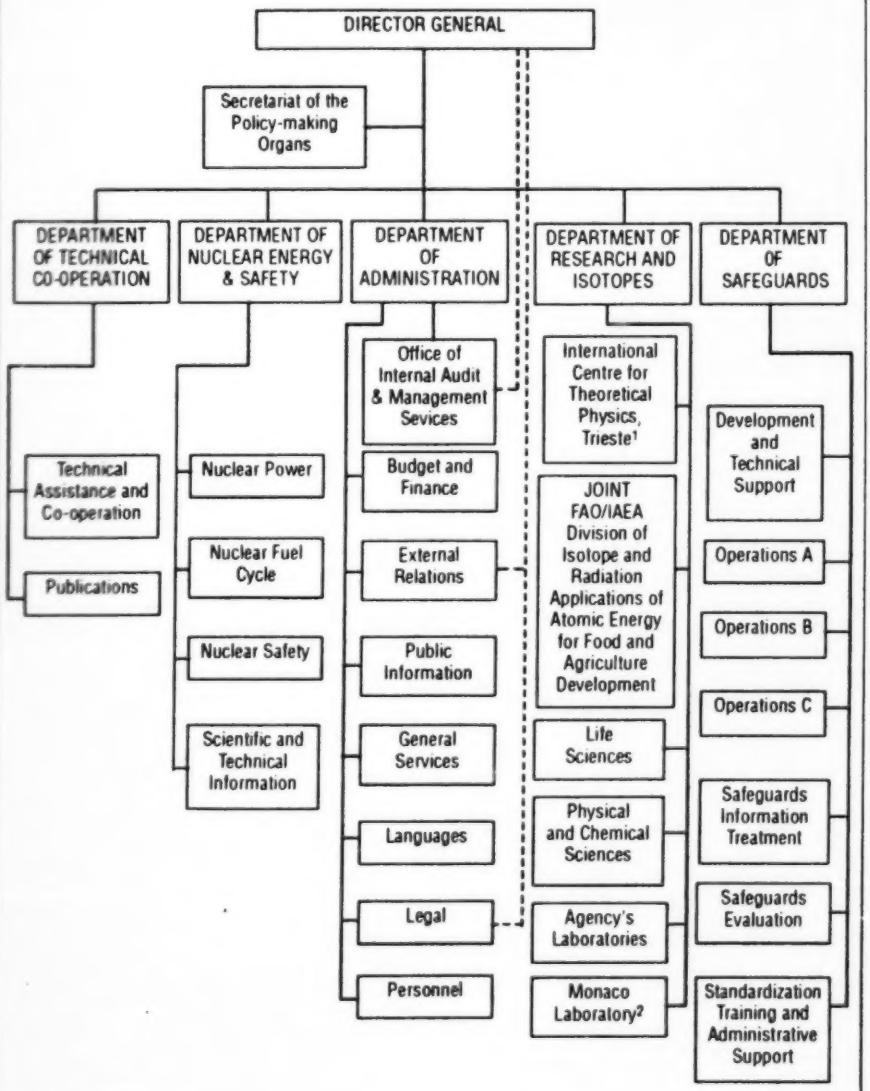
Internal Functioning

Political Structures

The development of the safeguards function in the IAEA is connected to both the characters of and the relationship between its two political organs, the General Conference and the Board of Governors. The Agency's Statute assigns rather general and weak powers to the General Conference. The Board is the central organ of the Agency, carrying out its functions, including important powers with respect to safeguards. Budgets, reports to the United Nations, the appointment of the Director General and some other activities require the agreement of the General Conference, but the Board retains among other things apparently sole rights to approve of upper-level staff appointments by the Director General (including of inspectors), to approve of safeguards policies and agreements, and to decide and act in cases of feared or actual non-compliance.

Given this centrality, the attitude of the Board— thus its composition— has been important. The development of the Agency's pre-NPT system depended on strong Western efforts on the Board, while the U.S.S.R. and its allies have more recently become strong supporters of safeguards. In general, the advanced, non-Third World, nuclear states on the Board have been supportive of safeguards. The rules of composition of the Board, which take nuclear technological or supply status into account as well as geographic distribution, have tended to favour these states — certainly in the early days of the Agency and even now relative to the General Conference despite the expansion of the Board and the increase in its elected component. One should note, then, both the expansion of the Board as the number of Agency members has increased, and the larger elected component, together with continuing pressures for a revision of the Statute Article on the Board. Clearly, several states are unhappy with the present state of affairs.

Figure 5 Organization Chart of the IAEA



1. Jointly operated by the Agency and UNESCO.
2. With the participation of UNESCO and UNEP

Source: IAEA, *The Agency's Budget for 1988*, GC(XXXII)/802, p.161

The Board shows the desirability, for management as well as for reasons of politics, of having the functioning of a safeguards agency firmly under the control of a small, effective executive body dominated by states with a strong interest in safeguards. It also demonstrates the problems that such a set-up can create. One might question whether dissatisfied states, drawing on their experience with the Agency, would support a similar concentration of authority in the executive body of a chemical weapons verification agency, or similar rules for its composition.

If significant powers were given to a body analogous to the Agency's General Conference, the higher degree of "politicization" of that body might be an inhibiting factor. Although restricting an agency purely to a verification function might reduce some of the problems, others could still be anticipated and might work to the detriment of such an agency. Areas of particular concern would be powers with respect to the development, implementation and oversight of the safeguards function, as well as the ability to follow up compliance problems at the political level. These powers should presumably be vested where they can be exercised most effectively and reasonably. It is not clear that the best entity would be composed of all members, even assuming a strong general commitment to safeguards. If the role of a political body in judging whether or not there is compliance with obligations raises concerns, it is hard to see how these would be reduced by vesting such powers in a general membership body which could be even more subject to the feared disabilities and abuses.

There is no veto on the Board, even for questions of non-compliance, and this practice seems to have worked well. A tradition of consensus decision-making has developed within the Agency, but this has not always been the case nor is it necessarily desirable. During the early development of the Agency's safeguards, majority votes were required in the Board. The current process of consensus-formation may tend to restrict Board activity, even though it reduces overt disagreement. If voting began occurring more frequently in the Board, it could be attributed to politicization, and could therefore be a bad omen. It seems impossible, therefore, to consider the effect of particular decision-making rules without also considering the political climate of the organ concerned and of the agency as a whole.

The Director General

The Director General is the chief administrative officer of the Agency. He or she is appointed by the Board, with the approval of the General Conference, for a renewable term. Some of his or her appointments, such as deputy directors general and inspectors, are subject to Board approval, as is the preparation of the budget. The Director General is required to submit reports to the Board regarding instances of possible non-compliance.

The Director General must be able to give strong direction to the staff. This strong direction becomes even more important if, as safeguards systems and policies are developed, the initiative gradually shifts from the Board to the Secretariat. Fischer and Szasz have noted such a possibility as a result of changes in the Board's composition as well.[7] But active directors general may be less welcome to the Board of Governors than more passive ones. An additional problem is the development of pressure from the Third World for a Director General from their group. This could have repercussions in the Agency for appointments, priorities and policies.

The model provided by the Agency for the Director General's position would seem broadly useful for a chemical weapons verification agency. However, the specifics of the Agency's Director General should be more closely examined.

Staffing Policies[8]

The terms of employment of Agency personnel seem to be a problem at the lower professional levels. Only a very small absolute number of persons are permanently on staff. A substantially larger number are on contracts of five years or so, with a possibility of renewal. Many, however, are essentially short-term or have little prospect for promotion. Some are rotated out every two to three years as a home state policy.

There is also the question of what sort of people one wants to attract. Getting people who already have good qualifications is desirable, since it reduces the training load on the Agency, but it also reduces representation from the Third World, where there are fewer trained people available for international positions. Increasing the intake of less qualified people creates unease about credibility and requires greater training efforts.

Do people see the Agency as offering a long-term career? If the job is seen as temporary, does it enhance or hinder one's professional status? Are highly qualified people needed, even if only for short rotations, or longer-term personnel who can develop in the job and see it as more than a temporary stop-over? A career staff has some advantages over a short-term staff, but also creates the danger of an ingrown organization, a danger increased if other personnel policies do not succeed in attracting good and loyal personnel who will enjoy the confidence of states.

The personnel policies and experiences of the Agency should receive closer examination, not only because of its apparent relative success compared to other international organizations but also because of the fundamental personnel decisions they reflect.

The Inspectorate

Candidate inspectors are approved by the Board of Governors before they are designated to specific states. There are difficulties with the designation process, which have been noted earlier, but there is no record of the Board exercising its power to refuse a proposed candidate. Although inspection activities may be concentrated among the personnel of the Operations Divisions of the Department of Safeguards, there is no necessity for inspectors to be drawn from those personnel. This peculiarity, a result of initial organizational problems in the Agency,[9] has an advantage of allowing the Agency to draw on its entire staff for inspectors.

Although, like others in the professional staff of the Agency, personnel intended for inspection activities probably enter the Agency with already high qualifications, some initial training (and later retraining) is necessary. Such training is supplied by a unit in the Safeguards Department. Some adjustment problems may develop if an inspector has an academic rather than an industry background. Some General Service personnel are now also being employed in inspections, to carry out routine maintenance work for which an inspector would be overqualified.

The inspectors are subject to the same general staffing difficulties as the Agency staff as a whole, to which must be added the burden of travel and their working conditions. The effects of these general problems on the inspectorate in particular should be examined, as should the problems presented by colonization, sponsorship and the use of geographic criteria. The problem of a career versus a short-term staff arises here, as elsewhere. It is not clear that being an inspector raises one's employment prospects on leaving the Agency, or that it is as attractive a job as others that may be available in the nuclear industry. Although many inspection personnel may be on long-term contracts, there are still limits on tenure and promotion.

In assigning inspection teams to various countries, the Agency avoids having a state inspected by its own nationals and having more than one national of a given state on a given team. It also avoids assigning the same person to the same facility twice in a row. Inspection personnel may be rotated through other Agency positions, for example in the Department of Safeguards, to increase their familiarity with other aspects of safeguards operations. The general policies used in inspection assignments seem to work fairly well, although designation problems and manpower limitations create difficulties. These policies might be studied more closely as a possible model for a chemical weapons verification agency.

Department	1987 Budget*	Professional Staff	General Service & Other Staff
Director General Secretariat of Policy-Making Organs	6 074 000	8	6
Technical Co-operation	7 11 4 000	46	69
Nuclear Energy and Safety	24 219 000	101	85
Research and Isotopes	21 106 000	109	160
Safeguards	43 846 000	277	193
Administration	25 999 000	74	198
Shared Support Services	4 435 000**	119	238
Total	**132 793 000**	**734**	**949**

Table 4

IAEA Departmental Budgets and Personnel Levels, 1987

*U.S. dollars
**Less cost of services charted to Agency programme
Source: IAEA, *The Agency's Budget for 1988*, GC(XXXI)/802, p. 81 and pp. 84-85

Division	1987 Budget*	Professional Staff	General Service & Other Staff
Co-ordination Section	363 000	1	2
Operations A	8 366 000	71	31
Operations B	6 256 000	49	27
Operations C	7 428 000	62	37
Development and Technical Support	11 346 000	33	31
Safeguards Information Treatment	5 810 000	29	36
Safeguards Evaluation	2 299 000	21	15
Standardization Training and Admin. Support	1 978 000	12	14
Total	**43 846 000**	**278**	**193**

Table 5

Divisional Budgets and Personnel Levels, IAEA Department of Safeguards, 1987

*U.S. dollars
Source: IAEA, *The Agency's Budget for 1988*, GC(XXXI)/802, p. 115

Support Services

As already noted, the Agency depends on the supply of certain resources and related services by states. However, it also provides some essential support services itself for its inspection activities. The Department of Safeguards has, besides its Operations Divisions, the following support divisions:

- **Development and Technical Support.** This division provides technical services, including new containment and surveillance devices and analytical routines, and the development of safeguards criteria.

- **Safeguards Information Treatment.** This division provides information management services, including documentation and data evaluation.

- **Safeguards Evaluation.** This division provides assessments of the safeguards systems and a Safeguards Implementation Report indicating areas of difficulty or of possible improvement.

- **Standardization, Training and Administrative Support.** This division provides management and secretarial services, financial and personnel control, and training. It also tries to standardize safeguards.

The Operations Divisions carry out inspections, and also undertake preliminary planning on the basis of design information, the updating and revising of inspection routines, the evaluation of inspection reports and the preparation of subsidiary arrangements.

While a chemical weapons verification agency might not have the same breadth of functions (such as the technology transfer function) as the IAEA as a whole, it would still require a variety of support services such as those listed above. These requirements, in the type of services, organization and the levels of support needed, should be taken into account in any planning for the size and the resource base of such an agency. While in some cases some supporting functions could be provided by states, doing so could limit the independence of such an agency. Additional needs could arise if such an agency tried to take into account possible new developments in the chemical weapons area, undertook to monitor more than industrial facilities, or use techniques in addition to materials accounting, containment and surveillance.

The Safeguards Systems

Detailed Verification Objectives

The broad objectives of the Agency's safeguards activities were noted at the beginning of this report, as were some operational difficulties in meeting detailed safeguards goals. Problems may also arise in middle-level statements of Agency objectives. While some of the difficulties may be semantic in nature, they can still be important, since they can contribute to misunderstandings of organizational goals and planning, and to ill-founded suspicion or reassurance about the Agency's safeguards.

Two particular problem areas are the relationship between treaty obligations and safeguards, and the phrasing of compliance objectives. Not all treaty obligations may be verified by agency safeguards. For example, non-nuclear parties of the NPT are prohibited from acquiring or manufacturing nuclear weapons, but the Agency can only safeguard declared nuclear materials in peaceful facilities against diversion. Other routes to nuclear explosives are not covered by the safeguard obligations of the Treaty or by the more detailed safeguards agreements under it. Verifying compliance, strictly speaking, like providing positive confirmation of a proposition, is extremely difficult in logical terms: "all swans are white" can be disproven by one black swan, and the statement is only tentatively true until all swans are known to have been seen and to be white. Establishing non-compliance — disconfirming a proposition — is less demanding logically, but it may be very difficult to prove empirically that materials are, for example, being diverted to proscribed rather than to other or merely to unknown purposes.

It should be emphasized that INFCIRC/153 provides for the application of Agency safeguards to all nuclear materials for all peaceful nuclear activities in a state, to verify that this material is not diverted to nuclear explosives (paras. 1, 2). Its more technical statement of objectives, however, adds "or for purposes unknown" (para. 28). Finally, the Agency is authorized to report to its members and to the General Assembly and Security Council of the United Nations when the Board of Governors "finds that the Agency is not able to verify that there has been no diversion" (para 19).

The problems of establishing non-compliance are bypassed in these additional statements, since the Agency need not prove a violation but merely needs to consider that it cannot verify adequately. Difficulties in the application of the safeguards system may be sufficient to count as anomalies requiring further investigation, and the inability to resolve these satisfactorily could trigger such a finding.[10] The ambiguity of an anomaly is thus enlisted on the side of the verification objective rather than against it. The Agency does not verify that no diversions are occurring, but instead satisfies itself that it should not reasonably fear diversion. This shift in wording and requirements should be

Figure 6 IAEA Inspections: Installing and Checking Containment Seals

Under the auspices of the Canadian Safeguards Support Programme, Atomic Energy of Canada Ltd. has developed several pieces of equipment for the use of IAEA inspectors. Among them is the ultrasonic random coil seal (A) which is designed to be used underwater on stacks containing spent CANDU reactor fuel. They are installed using a long rod (B) and can be routinely checked by inspectors using an electronic probe and a special Seal Pattern Reader (C). Each seal contains a wire coil. When an ultrasonic wave is sent to the seal, the coil creates a unique reflection pattern which is destroyed if the seal is tampered with or removed (D).

Installation and checking of containment equipment such as seals is an important element of the work conducted on site by IAEA inspectors. The ultrasonic random coil seal illustrated here is one of a variety of seals used by the IAEA.

noted. A chemical weapons verification system might adopt a similar "reasonable fear of non-compliance" approach.

Inspections

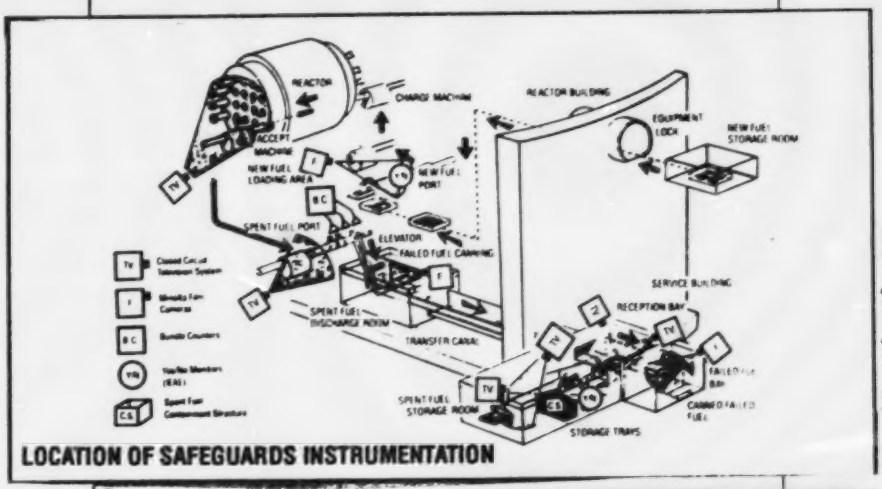
The Agency's inspection procedures are relevant for a chemical weapons verification agency in a variety of ways. The Agency has worked out, with reference to a set of industrial processes, the requirements of record-keeping, reporting, surveillance and containment instruments, measurement and counting, and sampling procedures. These also include general limitations on the conduct of inspectors as well as on the rights of states and plant operators. There are also potentially educative provisions governing when materials shall come under safeguards, how and when they may be withdrawn from safeguards, and when safeguards may be terminated.[11] Beyond this level of technical detail, there are other lessons to be learned from the Agency's inspection systems.

The Agency has developed three types of inspections — ad hoc, routine, and special — depending on the circumstances of application. Ad hoc inspections are carried out for transfers of nuclear material into and out of a state, to verify initial quantities of material subject to safeguards, or to deal with changes in a facility since an initial report was made. Routine inspections are the regular safeguards inspections conducted by the Agency. Special inspections are carried out if additional information is needed. Each of these types has its own notice, access and procedural rules. The differentiation among types of inspection indicates that inspections may serve a variety of purposes, and that their requirements may vary accordingly. In addition, the concept of routine inspections reduces the aura of suspicion around inspections in general: because inspections are undertaken routinely, they do not necessarily imply suspicion of non-compliance. Routine inspections have the further advantage that they become incorporated into the ordinary operation of a plant, and thus become less disruptive.

Even special inspections need not imply suspicion, since they may be responses to other circumstances that indicate possible problems with containment measures. Therefore special inspections are not associated with the concept of challenge inspections, although there will be overlaps between the two, at least so far as inspections at declared facilities would be concerned. The possible adaptation of the Agency's special inspection procedures to challenge inspections, including at suspect but undeclared facilities, should be examined.

Depending on the amount of nuclear material at a facility, the intensity of Agency inspections will vary, from once a year to possibly continuous inspection. INFCIRC/66 allows some unannounced inspections, and INFCIRC/153 allows some inspections that are unannounced and planned on a

Figure 7 IAEA Inspections: Surveillance Equipment



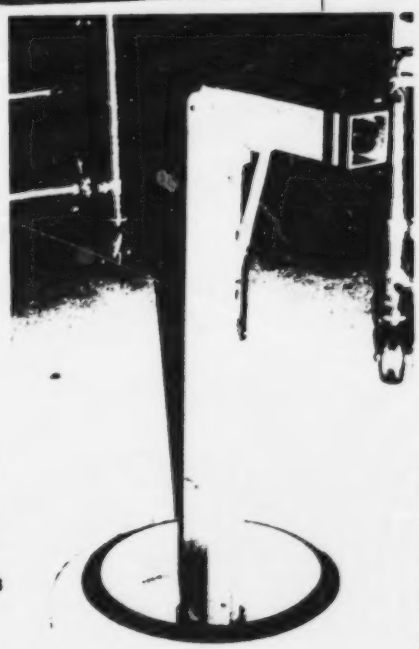
LOCATION OF SAFEGUARDS INSTRUMENTATION

Canadian Safeguards Support Programme

A

Another important contribution by Atomic Energy of Canada Ltd. under the auspices of the Canadian Safeguards Support Programme, to assist IAEA inspectors, is the development of a surveillance system for CANDU reactors. Shown in the diagram is the safeguards scheme developed by Canada for the CANDU 600 reactor (A). This system includes specialized equipment such as a closed circuit television (CCTV) camera used to continuously monitor the reactor face (B).

The installation and maintenance of tamper-indicating surveillance devices, including TV and photographic cameras, are important on-site activities of IAEA inspectors. Videos and films from such equipment are usually reviewed at the IAEA's headquarters in Vienna. Other major on-site activities of IAEA inspectors include installing and checking containment seals (Figure 6) and the review of a facility's materials accountancy records.



Canadian Safeguards Support Programme

B

principle of random sampling. Both of these, however, are within the general program of routine inspections developed by the Agency and communicated to states.

Although unannounced or "surprise" inspections are permitted, Fischer and Szasz suggest that their usefulness could be limited. Simply obtaining the necessary visas could be a source of delay, so that they become "short-notice" inspections. In addition, the successful technical performance of an inspection may benefit from or require advance notice to a facility.[12] This possibility should be borne in mind in any consideration of challenge inspections. Although blatant violations (e.g., the mere existence of an undeclared facility, or a very clear violation at a declared facility) might be readily detectable by a short-notice visit, more subtle violations might be difficult to detect in the "disruption" that such an inspection could create.

A final lesson from the Agency's experience is the general need to recognize that inspection, as a specific set of techniques, interacts with the other safeguards techniques employed by the Agency. Separating inspection from its context of the goals of safeguards, the activities being safeguarded, and the array of techniques employed must result in a very limited appreciation of the implications of inspection. Inspection is the central element of the system, but it is also in part defined by the other elements. Materials accounting, containment and surveillance techniques are used to simplify the inspector's task and to reduce the disruption caused by inspections. In turn, one task of the inspector is to verify the integrity of the other elements of the safeguards system. Inspection may compensate for some weaknesses in other techniques, but may also be weakened by them. A need to perform frequent maintenance on containment or surveillance devices, for example, could divert the energies and attention of an inspector.

Anomalies

Anomalies are not necessarily proof of diversion: they are simply unusual occurrences that *could* indicate a diversion. They could also arise through inaccuracies in accounting systems, plant operation practices, accidents, or other sources. They may, in a sense, be creations of a safeguards system itself. Some, such as broken seals or instrument malfunctions, would not exist in the absence of a safeguards system. The RECOVER (Remote Continuous Verification) system, developed by the Agency as a means of monitoring the functioning of some containment and surveillance devices, would be as valuable for monitoring instrument malfunctions as for its possible real-time protection against tampering. The problems and progress in developing this system should be studied. Other anomalies, such as significant levels of Material Unaccounted For, depend on what levels are deemed significant by the safeguards system, and thus reflect appreciations of risk as well as limits of technical sensitivity.

Anomalies must be interpreted before their significance is clear. Given the problems of establishing compliance in a strict sense, and assuming that states attempting diversions would try to confuse the safeguards system, even significant anomalies are likely to present considerable ambiguities. This is why allowing the Agency to report if it cannot verify compliance to its own satisfaction is important: inability to resolve an ambiguous situation may be sufficient to satisfy this condition.

Assessing anomalies is both a technical and a political matter. Technical judgements will be required regarding the qualities of various measurement, counting, data-handling and analytical procedures. The safeguards system must be designed to avoid excessive sensitivity to trivial cases while retaining an ability to spot significant cases. Significant anomalies will be passed to higher levels in the Agency, levels which are more political in their nature. This gradual imbuing of anomalies with political qualities cannot be avoided. What can and should be avoided is any possibility for significant anomalies to be overlooked in the lower levels of an agency. A safeguards system's inspection, reporting, analysis and internal information-management procedures must be designed to avoid such a weakness. The Agency's systems for the detection and handling of anomalies should be studied with this specific problem in mind.

Safeguards Evaluation and Improvement

The Agency has established a system for the evaluation of its safeguards. This system results in the production of a Safeguards Implementation Report, a confidential document. It would be useful to examine in more detail the performance of this evaluation system, the usefulness of the Safeguards Implementation Report, the sorts of problems (particularly recurring problems) and the response of the Agency to deficiencies and difficulties noted in these reports.

Notes

1. Schiff, pp. 106-116.
2. See *ibid.*, pp. 75-76, for a brief discussion of general personnel difficulties in the Agency.
3. Fischer and Szasz, p. 65.
4. Schiff, p. 141.
5. Fischer and Szasz, p. 61.
6. *Ibid.*, p. 43.
7. *Ibid.*, pp. 88-97 passim.
8. See footnote 2 above.
9. See Szasz, pp. 607-609, for an explanation of the origins of this practice.
10. Some classes of relevant anomalies are briefly noted in IAEA, *IAEA Safeguards: Implementation at Nuclear Fuel Cycle Facilities*, IAEA/SG/INF/6, p. 13.
11. The Agency's systems are outlined in *ibid.*
12. Fischer and Szasz, pp. 30-31.

Part 3. Summary and Conclusions

Some Lessons from the IAEA's Experience

A variety of "lessons" may be suggested from a consideration of the IAEA's experience as a verification organization. These include not only what phenomena have or have not been problems for the Agency but also how and with what degree of success it has dealt with them. Problems, of course, are more readily visible, while success is often apparent only in comparison with other organizations or by considering what did not happen. What follows is an attempt to distil at least some elements along these lines from the body of this study. The divisions used below are an attempt to organize (in some cases to reorganize) the material usefully, but they are to some degree arbitrary.

Broad Objectives, Tasks and Threat Coverage

1. Verification by an international agency in sensitive areas of state activity, through the use of on-site inspection and associated intrusive techniques of materials accounting, instrumentation, etc., is not inherently infeasible. However, its specific viability and mechanisms will vary from one context to another. The broad problems to be dealt with by a verification agency and its objectives with respect to those problems must be clearly defined and the implications of various mechanisms to deal with those problems must be carefully considered.

2. Both the separation and the combination of the broad objectives of disarmament and of non-proliferation (in the horizontal sense) may have advantages and disadvantages. Pursuing non-proliferation alone may raise charges of inequity and of support for the states that already have the weapons. Pursuing disarmament alone could raise problems in a non-universal agreement, if non-parties possessed or acquired and used the weapons. Pursuing both disarmament and non-proliferation would reduce or avoid some of these problems, but one would continue to face problems resulting from possible transfers and exports of sensitive materials to non-parties.

3. The basic problem of non-proliferation, whether or not the sole focus of an agreement, may be defined in at least two ways: end-uses or latent proliferation. The first requires an ability to make meaningful distinctions among desired and undesired uses, and to operationalize these through controls. This is the route the Agency has taken. Such an approach limits the threats which the Agency covers in its safeguards systems, and thus the assurances it can offer even if its systems are

credible. Adoption of a "latent proliferation" approach, which focuses on controlling the spread of a technological capacity to make the weapons in question, raises the question of exports or transfers. Dual-capability materials raise problems for both approaches. For parts of the chemical industry, adoption of a latent proliferation approach might be very difficult because of the widespread availability of chemical plant and materials.

4. To avoid misapplication of effort, misunderstanding, and ill-founded suspicions, there must be clarity about the relationship between the activities of a verification agency and the obligations of states in a control agreement: not all obligations may be covered by the Agency's activities. Beyond that, differing verification objectives may present logical and empirical difficulties, for example, in "verifying compliance" or in "establishing non-compliance." Under INFCIRC/153, the Agency may report if it is "unable to verify that there has been no diversion." In practice this seems to imply that it would report any reasonable fears of diversion. This enlists ambiguity on the side of the Agency rather than against it.

5. The routes to acquiring nuclear weapons or the "threats" covered by the Agency are limited by (a) its definition of the arms control problem in end-use terms; (b) its focus on declared, civilian nuclear activities; (c) its use of two safeguards systems, one item-specific and the other full-scope; (d) its inability to address, including in its distribution of effort, the differing types and levels of political risk of proliferation; (e) its inability to address the different motivations for the acquisition of nuclear weapons or a nuclear weapons capability; and (f) possible differences between the obligations that states assume in non-proliferation agreements and the precise activities covered by its safeguards systems.

Safeguards Character and Effectiveness

1. For a variety of reasons, the Agency applies more than one safeguards system. This complicates its efforts and their results. Some coherence is maintained by efforts to bring its two systems into a closer correspondence (although this has also been resisted), by the development of guidelines for its systems, and by the requirement that the Board of Governors approve safeguards agreements. The Agency is thus not obliged to accept and apply whatever safeguards that states may agree on in a bilateral interstate agreement.

2. The problem of handling transfers of controlled materials from parties of an arms control agreement to non-parties can create multiple safeguards systems unless a uniform requirement for such exports is part of the agreement. The possibility of applying some form of safeguards to non-parties, and how its various implications shall be handled, should be allowed for from the start.

3. Aside from considerations of threat coverage, safeguards' effectiveness is also limited by technical and resource factors. Nonetheless, a system so limited may still perform at politically adequate levels. Where levels of relevant risk are low or moderate, imperfections can be tolerated: the effect of the safeguards is to reduce "background noise." Where potential proliferators are covered by safeguards, the effect is to complicate proliferation plans and to increase costs, while these proliferators may draw attention to themselves and may then be subject to other pressures by states. Similarly, states which avoid safeguards obligations draw attention to themselves.

4. In the process of operationalizing safeguards rights, procedures and criteria, and applying them at the level of specific facilities, it would seem normal to expect some narrowing of their scope. Beyond that, there are a number of dangers that may constrain or misdirect Agency efforts and rights:

   a) As general performance criteria are applied in specific technical contexts, they may fall short of initial goals. The distinction between broad criteria and specific performance standards may be inevitable, but it should also be carefully monitored.

   b) The process of updating safeguards, or of replacing one safeguards agreement by another, may produce opportunities for the reinterpretation of requirements or the introduction of additional constraints. Similar opportunities may arise in negotiations for the application of general safeguards rights and procedures to specific facilities.

   c) There may also be a tendency to confuse measures of inspection effort with measures of effectiveness.

5. The Agency's mix of safeguards techniques has been determined by considerations of intrusiveness and acceptability, as well as of adequacy and the nature of safeguards objectives and the safeguarded activities. Although containment and surveillance can ease some of the problems for materials accounting presented by some types of facilities, they also have limitations. Even so, because considerable emphasis has been given to materials accounting as the primary safeguards methodology,

there could be difficulties in shifting away from a favoured methodology to others that may be more appropriate. With respect to the safeguarded activities, the Agency focuses on industrial production processes. In these, its control systems may overlap to some degree with, and thus exploit, state regulatory and plant operation control systems. If other sorts of activities were monitored, however, other indicators and techniques would be relevant.

6. The use of inspection as a safeguards technique must be considered not only with respect to the activity safeguarded and the objective of safeguards but also with respect to the other techniques with which it will be employed. These can both ease and complicate the inspector's task, as well as make it more acceptable to safeguarded states and facility operators. One task of the inspector is precisely to verify the integrity of the broader safeguards system as applied at a specific facility.

7. The Agency's distinction among ad hoc, routine and special inspections suggests that such distinctions could be valuable and that different specific inspection purposes may require different routines and procedures. Special inspections present some possible similarities to challenge inspections, as do surprise or short-notice inspections. The limited Agency use of the latter, however, also suggests some potential difficulties for challenge inspections, at least at declared facilities.

8. Aside from difficulties with specific techniques, the Agency has had problems integrating its safeguards systems across Material Balance Areas within and between facilities. The handling of shipping information seems to be a particular problem, not only in the design of an information system but also in the performance of shippers and receivers. This difficulty limits the Agency's safeguards, including its ability to use interstate shipments to cross-check within-state data.

9. Anomalies should be regarded as more than just "objective" indicators of possible diversions. They may be created by a variety of conditions, and so must be investigated and assessed. They may also in a sense be artifacts of a safeguards system, or at least generated by the interaction of that system with its environment. This should affect both the design of a system and the interpretation of its findings. The interpretation and assessment of anomalies will inescapably have both technical and political aspects.

Safeguards-Supply Linkages

1. Linkages between safeguards and supply of materials may both support and hinder safeguards. Safeguards may be required as a condition for supply, and the acceptance of safeguards may also be taken as implicitly guaranteeing access. Improved access for those who accept safeguards may encourage acceptance of safeguards, but it may also complicate efforts to upgrade safeguards requirements, or efforts to implement measures based on a "latent proliferation" definition of the basic non-proliferation problem.

2. The duality of function in the Agency — its role as a technical assistance body as well as a verification body — blurs its objectives and complicates its structures and functioning. The competition between the two functions for resources exacerbates the division of the membership into different constituencies according to the functions they value. It might be more desirable to structure an organization around a single, well-defined function, and to assign other functions to it only if they are clearly secondary and supportive of the primary function.

The Political Support Base

1. While supplier support is needed for an effective control system over exports, too great a dependence on supplier power may create difficulties, not only because of problems of co-ordination and undercutting as the number of suppliers increases but also because the rights and interest of recipients must be taken into account. An organization including both recipients and suppliers may allow desirable co-ordination within and among these groups, with greater legitimacy for a safeguards system as a result. However, it may also hinder the use or effective implementation of a "latent proliferation" problem definition. This encourages action outside the organization, which in turn may create political strains. The alternative, however, may be a diluted or less technically effective safeguards system.

2. The detailed specification of a verification system in a founding document may present advantages of clarity in the obligations at the start. However, it may also hinder the evolution of a verification system in response to changing problems, techniques, and scope of application. All of these factors could generate a multiplicity of systems within and outside the agency, reducing its coherence, legitimacy and centrality.

3. The Agency has profited from the existence of a broad presumption against the spread of nuclear weapons. The limitations of this consensus have also indicated sore points in the politics of the safeguards system and in the control regime more generally.

Relations with Other Monitoring Organizations

1. Because of its limitations, the Agency must be considered only one verification agency, acting within a larger system of monitoring agencies, many of them national. It is a supplement or a complement to these agencies. Even provisions for challenge verification by an international agency would not fundamentally alter this relationship. The relationship between national and international monitoring agencies might be considered, and exploited in a mutually reinforcing fashion.

2. The existence of more than one international verification body in a given issue area may complicate the activities of a verification agency, but there may also be possibilities for mutually supportive relationships.

Organization and Functioning

1. The experience of the Agency's Board of Governors suggests the desirability of concentrating management powers in the hands of a small and effective executive body in which states with a strong commitment to the safeguards function have a strong position. The dissatisfaction that such a strategy might generate among other members should also be recognized, however.

2. The Agency's experience demonstrates that it is possible to develop a competent and credible staff, including inspectors, despite certain tendencies in the personnel policies and practices of international organizations. Some of its success must be attributed to the forbearance of states, but some must also be attributed to good upper-level management and apparently successful personnel policies, at least so far as avoiding state interference is concerned. However, the Agency's personnel policies seem to have difficulties particularly with respect to lower-level professional personnel and in regard to tenure, promotion and pay. The issue of a career versus a short-term staff must also be noted.

3. The Agency has had difficulties in devising an acceptable set of principles for financing safeguards in its regular budget. Although in theory one might argue that safeguards benefit the whole community, the approach ultimately taken could underline the difference in priorities which different states assign to safeguards. While this is exacerbated by the multiple functions of the Agency, the general problem of devising a financial formula and a set of principles should be noted for other verification agencies.

4. Partly related to the financing problem, but also partly due to its limited personnel, research and industrial base, the Agency depends on states for various extrabudgetary contributions and support for safeguards. While this both is inevitable and may have advantages, it may also produce certain frictions in the sense that some activities are likely to be deemed to be candidates for such support, while others are not.

5. More generally, the Agency's experience shows the necessity for a variety of support services, at adequate levels, for the performance of its safeguards functions. In some cases their adequate supply by the verification agency itself would seem more desirable than dependence on states.

Miscellaneous

1. The Agency safeguards are in some cases backed up by a network of bilateral safeguards agreements, which would come into play if the Agency were unable to carry out its safeguards function. While these bilateral requirements can complicate the Agency's efforts, they can also serve as a limited safety net. The problems and possibilities of co-ordination between agency safeguards and national export controls in a chemical weapons convention should be considered. However, the limitations of these bilateral arrangements if a state were determined to withdraw from or violate obligations should be recognized.

2. The Agency has very limited sanctioning powers. Of these, its greatest may be simply its right to report and to publicize instances of its inability to verify compliance. This may be a realistic sanction for a verification agency.

3. An international verification agency offers side benefits through providing a forum for continued consultation and co-ordination, and a mechanism through which ambiguous cases might be dealt with before they become major political problems.

Areas for Further Study

The foregoing sections have reviewed IAEA safeguards and suggested some "lessons" that might be applicable in other verification contexts, notably a chemical weapons convention. The following paragraphs suggest areas where further research would be fruitful.

1. A system of safeguards integrated across Material Balance Areas, facilities and states presents possibilities for cross-checking. However, deficiencies in the Agency's safeguards systems with respect to the management of shipments of items between facilities and/or from one state to another also exist and should be examined. These could include not only problems in the design of information systems to keep track of such movements but also problems in achieving adequate performance on the part of shippers and receivers.

2. Problems in the specific statistical techniques used by the Agency – e.g., the calculation and use of MUF figures – should be examined. So should the difficulties which the Agency faces in closing materials balances, and the efforts it has made to solve these problems.

3. The Agency's procedure for the evaluation and improvement of its safeguards should be studied. As well, the Safeguards Implementation Reports should be examined to see what sorts of problems they uncover, and particularly those problems that recur.

4. The relationship between bilateral safeguards and multilateral safeguards should be considered. The former may complicate but also may supplement the latter. They may also be a source of political tension.

5. Some thought should be given to the problem of safeguards over exports of chemicals, plant or technology from a party to a chemical weapons convention to a non-party. What items should be safeguarded and what should the character of those safeguards be? Should appropriate safeguards requirements be included in a convention, or worked out within the verification agency, or should they be worked out among principal suppliers, on the models of the NPT and the later Nuclear Suppliers Group?

6. The relationships between the IAEA on the one hand and EURATOM and OPANAL (the governing body for the Treaty of Tlatelolco) on the other should be studied, for guidance on the problems and possibilities of co-ordinating safeguards systems with regional control agencies.

7. The functioning of the Agency's relationship with the United Nations system should be examined. A chemical weapons verification agency could be connected in some way to the United Nations system, and the difficulties this arrangement might create, and how these might be approached, should be considered.

8. The Agency's Director General position suggests a model for the chief administrative officer of a chemical weapons verification agency. However, the history and character of this position should be studied in greater detail.

9. The Agency's personnel policies and practices should be closely examined, with respect to both its general staff and its inspection personnel. The Agency seems to have been able to deal successfully with some problems found in other international organizations, such as colonization of positions, sponsorship, and geographic criteria of recruitment. On the other hand, its policies on promotion and tenure, and its problems in attracting lower-level professional personnel, indicate some difficulties. The relative merits of a career staff (especially an inspectorate) as opposed to a short-term staff should be carefully considered.

10. The Agency's information management should be examined, from the perspective of a variety of issues that will also arise for a chemical weapons verification agency. First, what information is necessary for safeguards on industrial production processes? Second, what overlaps exist between the information requirements of Agency safeguards on the one hand and national and plant operator controls on the other? The Agency probably exploits some compatibilities in this regard, but there could also be incompatibilities that must be taken into account. Third, what "transmission problems" occur in acquiring data from national sources and plant operators, in terms of language, delays and other difficulties, and what steps might remedy these? Fourth, what are the information management practices and problems within the Agency, including the working-up of data and reports, the handling of anomalies to ensure that they are dealt with promptly rather than delayed or overlooked, and security procedures? Fifth, what information could reasonably be made public about the results of safeguards efforts?

11. The functioning of the Agency's Agreement on Privileges and Immunities seems to work fairly well. It should be studied, in general terms for the Agency and for inspectors, and particularly with respect to the difficulties that might arise for challenge inspections. Some other areas of study could include problems of the movement of samples and equipment, and of multiple- versus single-entry visas. The possibility of strengthening procedures under this agreement should be examined.

12. The possibilities of setting up Field Offices and issues raised by the example of the Agency's Field Offices should be studied.

13. The operation and effects of the Agency's designation procedure for its inspectors should be studied, with a view to discovering how some of its problems could be avoided through revised designation procedures or through other policies on the part of the Agency. Similar difficulties could be possible for a chemical weapons verification agency.

14. The working of the Agency's dispute settlement mechanism should be examined, both in general terms and in relation specifically to disputes over the application of safeguards and the resolution of problems arising from safeguards findings.

15. The Agency provides a variety of support services for its safeguards activities, and depends on states for others. The operation of its support services should be studied. More generally, the type, level, organization and supply of support services needed for a chemical weapons verification agency should be considered, using the Agency as a guideline, bearing in mind the specific safeguards activities it would be engaged in, the dynamic nature of the sector it would monitor, and the desirability for at least some independence from state-supplied services.

16. The problems and possibilities of the Agency's research into the Remote Continuous Verification (RECOVER) system should be examined, as a means not only of monitoring safeguards instruments but also, more generally, of developing means for remote, real-time monitoring of facility operations.

17. The Agency's different classes of inspections should be examined closely, to see if a similar classification and similar procedures could be of use in the chemical weapons area.

18. Any experience with surprise and special inspections should be considered for its possible application to challenge inspections.

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